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Plant Breeding Abstracts

Vol. XXXI, No. 2

C. A. B.
10 MAY 1961
FILE

STATISTICS

1169 Włodek, J. M.
Najwłaściwsza dla doświadczalnictwa rolniczego metoda rozwiązywania równań liniowych. (**The most appropriate method of solving linear equations in agricultural experiments**).
Zeszyt. nauk. wyższ. Szkoł. roln. Krakow. : Rolnictwo 1959 : **6** : No. 9 : 29–44.

An outline of the methods of Radhakrishna Rao, C. H. Goulden and T. Banachiewicz for use in multiple correlation analysis is given. The two methods of Banachiewicz, known as the Cracovian methods and involving multiplication of columns by columns instead of by rows as in matrix calculus, are regarded as most suitable.

1170 Schulze, J.
Zur statistischen Behandlung phänologischer Daten. (**The statistical treatment of phenological data**).
Wiss. Z. Humboldt-Univ. Berlin : Math.-Naturwiss Reihe 1958/59 : **8** : 717–25.

It is shown that the arithmetic mean and standard deviation are suitable statistics of phenological data. Tests with maize and sunflowers demonstrate that data for the phenological stages between sowing and emergence of the seedlings and between sowing and flowering meet the requirements for variance analysis. The carrying out of phenological experiments with wild plants is discussed.

1171 Coote, G. G.
The principles of conducting variety trials involving subjective judgements.
J. Aust. Inst. agric. Sci. 1960 : **26** : 241–45.

The various phases in experiments involving organoleptic testing are discussed, and incomplete block designs suitable for such experiments are presented. Particular reference is made to problems that may be encountered in the evaluation of results obtained from trials of this type.

GENETICS

1172 Broad, P. M. A.
The mechanism of inheritance.
Advanc. Sci. 1959 : **16** : 339–47.

A number of fundamental problems in genetics are discussed and illustrated in this prize essay.

Abstracts of papers for the 8th Annual Meeting of the Radiation Research Society, San Francisco, California, May 9-11, 1960.
Radiation Res. 1960 : **12** : 417–85.

1173 *Serres, F. J. Consequences of spontaneous and induced mutation in the* ad–3 *region of Neurospora.* (*pp. 430–31*).

Heterocaryon and crossing tests revealed the existence of two main classes of nonallelic mutants in the *ad*–3 region, *ad*–3A and *ad*–3B. Unselected samples of 160 *ad*–3B mutants were tested in all possible pairwise combinations and some rare instances of allelic complementation were observed; these *ad*–3B heterocaryons grow slowly at first, gradually attaining the growth rate of the wild type. In other experiments the proportion of mutants showing allelic complementation varied with the mutagen; the fractions were $\frac{9}{133}$, $\frac{21}{105}$ and $\frac{2}{3}$ for X-ray induced, ultraviolet-induced and spontaneous mutants, respectively. Amongst the *ad*–3B mutants, 5% of the "nonleaky" mutants showed allelic complementation in contrast to 100% of the "leaky" mutants. The majority of nonleaky mutants are multiple cistron mutants, 4 to 9 cistrons being involved, whereas most leaky mutants cover only 1 or 2 cistrons. No allelic complementation was found amongst 29 leaky and 35 nonleaky *ad*–3A mutants tested in all possible pairwise combinations. The data suggest that *ad*–3A is a single cistron locus and *ad*–3B a multiple cistron locus.

1174 *Engelberg, J. On the X-ray induced mutation of* E. coli *B/R to T^1 bacteriophage resistance.* (*p. 433*).

"In the case of an organism in which the killing and mutagenic actions of X-irradiation are both one-hit, the fraction, Pm, which gives rise to) mutant colonies is given by $Pm = 5(1-S^{1/r})$ where S is the fraction of surviving irradiated cells, and r is the ratio of the target volume for killing, Vk, to the target volume for mutagenesis, Vm. It is assumed that if there are no hits in Vk, then one or more radiation hits in Vm lead to the mutation in question. When r is large it can be shown from the previous equation that a maximum yield of recoverable mutants per irradiated cell is obtained when the population is irradiated so as to yield $S = e^{-1} = 0{\cdot}368 = 36{\cdot}8\%$ survivors. Application of this equation to the data obtained by Demerec and Latarjet [XVIII, 1458]* on X-ray induced (end-point) mutation to T^1 bacteriophage resistance in *E. coli* B/R leads to a value for *r* of about 50,000. From this it is inferred that the apparent target volume for the mutation in question encompasses one to three-hundred nucleotide pairs in the bacterial DNA."

1175 *James, A. P. Radiation-induced extra-chromosomal mutation in yeast.* (*p. 445*).
A strain of yeast, which produces respiratory-deficient mutants at a high rate spontaneously, was subjected to ultraviolet irradiation, and the results indicate that the assortment of extra-chromosomal particles is normal in irradiated cells but the number of particles is reduced either by destruction or by a reduction in the rate of duplication.

1176 *Krieg, D. R. Ultraviolet-induced mutation of extracellular bacteriophage T4.* (*p. 450*).
"Mutations of bacteriophage T4 can be induced by irradiation of extracellular phage with germicidal ultraviolet light (UV). The mutants are detected among the progeny phage produced in unirradiated host bacteria. Both 'forward mutations' and 'reverse mutations' from a number of different r_{II} alleles have been investigated. The results to date are compatible with the intepretation that the UV acts directly on the genetic material so as to increase the probability of mutation when the irradiated genes subsequently duplicate; however, other conceivable interpretations are also being tested".

1177 *Mortimer, R. K. & Brustad, T. Mutation induction in Saccharomyces using radiations of different linear energy transfer.* (*p. 458*).
"A diploid strain of yeast has been developed with which it is possible to study radiation-induced reverse mutation at three loci, as well as effects attributable to mitotic crossing-over or deletion at a fourth locus. The induction of these genetic effects was studied as a function of linear energy transfer, using X-rays, 40 mev alpha particles, and 120 mev carbon nuclei. The frequencies of mutation induction were comparable for X-rays and 40 mev alpha particles. However, the more densely ionizing carbon nuclei were found in all cases to be more efficient or as efficient as these two radiations for induction of genetic changes. These results are considered in relation to different models proposed for radiation action on living cells."

1178 *Smith, H. H. Genetic control and radiation effects with Nicotiana tumours.* (*p. 475*).
Tumour formation appears to be controlled by "conventional" genes [cf. XXVI, 981]. The nontumorous condition seems to be dominant. Genotypes involving *N. glauca* and *N. suaveolens* combined with genomes or gene recombinations of *N. langsdorffii* and *N. sanderae* were grown for about 108 days with γ radiation at 5 to 400 r. per 20 hr. Some of the genotypes, including a radiation-induced mutant, produced no tumours either in unirradiated controls or at any level of irradiation, whilst others proproduced tumours at all dosages and in the controls. Another group developed tumours late in the season and only after γ irradiation at 200–350 r. per day according to the genotype.

1179 *Sparrow, A. H. & Miksche, J. P. The relationship between chromosomal, nuclear, or cellular size and the radiosensitivity of different plant taxa.* (*p. 474*).
The radiosensitivity of more than 200 different taxa was determined by exposing the growing plants to chronic γ radiation from Co^{60} for several weeks; the degree of growth inhibition was used as a measure of radiation damage. Radiosensitivity could be correlated with the average size of the chromosome, nucleus or cell (of a meristem) or with the average amount of DNA per nucleus.

1180 *Sybenga, J. The effect of gamma rays on frequency and localization of chiasmata in* Crotalaria intermedia. (*p. 478*).
A tendency towards a decrease of chiasma frequency after irradiation was found but this was not significant and no effect on the localization of chiasmata was determined.

1181 *Tahmisian, T. N. & Brar, S. S. Cumulative irradiation of* Sequoia gigantea. (*pp. 478–79*).
Primordia of *Sequoia gigantea* have received 2000 to 4000 years of background irradiation. Seeds from the oldest trees in the Yosemite, General Grant and Sequoia National Park groves showed 70% viability. The somatic chromosome number was found to be 22 and chromosome stickiness in anaphase was rarely observed. It was calculated that the primordia received 115 r. per 1000 yr. and the roots 150 r.

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* References in square brackets are to volume and number of entry in *Plant Breeding Abstracts.*

1182 *Nimber, D. E. The effect of chronic gamma irradiation on the duration of the nuclear cycle in* Tradescantia paludosa *root tips.* (*p. 484*).

In the normal cycle, synthesis of DNA begins 4 hr. after the beginning of interphase and continues for 10·8 hr. but in the irradiated root tips, the synthesis begins about 55 hr. after the start of interphase and continues for 17 hr. Normally mitosis commences 2·7 hr. after DNA synthesis ceases and continues for 2·5 hr., the cycle taking 20 hr., but in the irradiated cells mitosis begins 10 hr. after the end of DNA synthesis and the total cycle averages 83 hr.

Vorschau auf die vom 25. bis 28. September 1960 in Hannover stattfindende 101. Versammlung Deutscher Naturforscher und Ärzte und die damit verbundene Schultagung. (**Programme of the 101st Meeting of German Scientists and Doctors taking place on 25 to 28 September 1960 in Hannover and the study meeting associated with it**).
Naturwissenschaften 1960 : **47** : No. 12 : Mitt. Ges. dtsch. NatForsch. Ärzte No. 2 : Pp. 8.

1183 *Kaudewitz, F. Bakteriengenetik: Methoden und Ergebnisse.* (*Bacterial genetics: methods and results*). (*p. 5*).

Genetical control of biosynthesis in bacteria is discussed and the function and structure of the locus is considered with special reference to the *C* locus of histidine synthesis in *Salmonella typhimurium*. Also the function of DNA is discussed.

1184 *Gierer, A. Molekulare Grundlagen der Vererbung.* (*Molecular bases of heredity*). (*p. 5*).

The structure, function and reproduction of nucleic acids are considered and also the catalytic action of enzymes.

1185 BALBINDER, E.
Mapping, complementation, and mutation studies with two tryptophan loci of *Salmonella typhimurium*.
Genetics 1960 : **45** : p. 973. (Abst.).

Eighteen *try*D and six *try*C alleles of spontaneous or induced origin were analysed. Transduction experiments revealed that mutations at 15 sites of the *try*D locus and at 6 sites of *try*C were responsible for the 24 mutants. The map order of the mutant sites was determined by three-point recombination tests involving two *try*D alleles and a *try*B marker or two *try*C alleles and a *try*A marker. Recombination frequencies were influenced by factors other than distance between the markers involved. Complementation tests by abortive transduction showed that the 18 *try*D mutants constituted one complementation group and the 6 *try*C mutants another. All *try*C mutants complemented all *try*D mutants and *vice versa*. These results agree well with Yanofsky's finding of two components for tryptophane synthetase in *Escherichia coli*, each component being determined by one of two adjacent loci. Each of the 24 mutants exhibited a distinctive pattern of reversion induced by 5-bromouracil, 2-aminopurine, diethyl sulphate, β-propiolactone and ultraviolet radiation. No relationship was detected between map position of a mutant and its response to the mutagens. In two cases, mutants belonging to the same site gave identical patterns of reversion. In a third, two mutants having the same site showed different patterns of reversion. Suppressor mutations analysed have proved to be allele specific.

1186 RAPER, J. R.
The control of sex in fungi.
Amer. J. Bot. 1960 : **47** : 794–808.

"Two major categories of controlling factors are recognized: (1) a predetermination of future sexual capacity follows from the segregation at meiosis of genetic factors that impose differentiation in respect to sexual sign or incompatibility type; (2) a coordinated progression of interdependent stages, governed by numerous genetic-metabolic factors, leads to plasmogamy, karyogamy, and meiosis. The major features of these 2 types of control—the several patterns of sexuality of the former and sexual hormones and sequential sexual development of the latter—are reviewed, and the possible relationship between the two levels of control is considered in some detail." [From author's summary].

1187 BREWBAKER, J. L. & EMERY, G. C.
Incompatibility allele mutations.
Genetics 1960 : **45** : p. 978. (Abst.).

Mutants of incompatibility alleles were sought in *Petunia* among about 12,000,000 pollen grains in 5 homozygous and 10 heterozygous genotypes, and 2 spontaneous and 63 induced "mutants" were identified genotypically. Spontaneous rates of mutation, based on seed recovered from incompatible matings of homozoygous clones, averaged 4·9 per 1,000,000 pollen grains, whereas the corresponding average for heterozygotes was 67·9. Premeiotic irradiations of 1000 r. increased these rates to 26·0 and 1980·0, respectively. Among the total 65 mutants were 21 with altered incompatibility behaviour, 17 being self fertile because of loss of activity in the pollen. All the self-fertile mutants analysed were the result of addition rather than deletion of an *S* locus. Such addition permits the inclusion of two different *S* genes in a single pollen grain, a condition leading to breakdown of incompatibility by "competitive" interaction. This condition was brought about in at least five plants by addition of an *S* gene carried by a centric fragment. Five other mutant plants were completely sterile and four ♀ sterile. All of the 18 plants from homozygous parents and 19 of the 47 from heterozygotes were of non-mutant genotypes expected as a result of chance weakening of the incompatibility barrier. No new alleles were obtained. The results cast some doubt on current theories of *S*-gene bipartite structure, revertible gene mutation and time of *S* gene action in microsporogenesis.

1188 Emery, G. C., Brewbaker, J. L. & Shapiro, N.
Polyploidy and self incompatibility in *Petunia.*
Genetics 1960 : **45** : p. 986. (Abst.).

Diploid seeds of five homozygous *S* allele genotypes of *P. inflata* were colchicine-treated and the corresponding homozygous tetraploids recovered. These tetraploids and the ten heterozygous 2*x* genotypes obtained by crossing the five 2*x* homozygotes were highly self incompatible, but all the corresponding 4*x* heterozygotes were self fertile as the result of competitive *S*-allelic interaction in the 2*x* pollen. Similar competition has been detected comparatively rarely among heterozygous 4*x* genotypes of *Oenothera organensis*, *Trifolium repens* and *T. hybridum*. Triploid heterozygous clones secured by crossing 4*x* homozygotes as females to unrelated 2*x* homozygotes were completely self incompatible. Cytological analysis indicated that viable pollen produced by the triploids was almost entirely haploid, thus eliminating the possibility of self fertilization by *S*-heterogenic pollen. About 50 trisomics have been recovered from crosses of triploids as females with 2*x* homozygotes and cytological identification of the chromosome-bearing locus *S* is receiving attention.

1189 Nujdin [Nuždin], N. I.
Unele probleme metodologice ale geneticii actuale. (**Some methodological problems in contemporary genetics**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. **4** : 97–122.

[Cf. XXX, 40].

1190 Kaudewitz, F.
Methoden, Denkweisen und Ergebnisse der Erbforschung an Bakterien. (**Methods, modes of thought and results of genetical research on bacteria**).
Verh. schweiz. naturf. Ges. 1959 : 75–97.

This detailed review includes descriptions of recombination, transduction and transformation. The chemical structure of the gene and the induction of mutations by chemical reactions affecting DNA are also discussed.

1191 Moutschen, J.
Action combinée du myleran et des rayons X et son importance au point de vue génétique. (**Combined action of myleran and X rays and its importance genetically**).
Hereditas, Lund 1960 : **46** : 471–80.

A detailed report is given of experiments already briefly reported [cf. XXIX, 1059].

1192 Bakhteev, F. Kh. [Bahteev, F. H.]
To the history of Russian science: Academician Nicholas Ivan Vavilov on his 70th anniversary (November 26, 1887 - August 2, 1942).
Quart. Rev. Biol. 1960 : **35** : 115–19.

A shortened translation into English is given of an article referred to previously [XXIX, 52].

1193 Fraser, A. S.
Simulation of genetic systems by automatic digital computers. VII. Effects of reproductive rate, and intensity of selection, on genetic structure.
Aust. J. biol. Sci. 1960 : **13** : 344–50.

In this further study of computer-simulated selection against phenotypic extremes in the presence of epistasis [cf. 22], runs have been made at reproductive rates of 10, 20, 30, 40 and 50 progeny per mating and at various selective limits. The effect of progeny size was small. It was found however that phenotypic variance suffered a greater reduction than was indicated by the selection limits, resulting in canalization of the character concerned.

1194 Wilson, D. E.
The effect of ionizing radiation on genetic recombination in *Escherichia coli.*
Rad. Res. 1960 : **12** : 230–36.

"High-frequency recombinant cells of *Escherichia coli* K–12 were irradiated with γ rays from a cobalt-60 source and tested for their ability to act as donors of genetic material of F⁻ receptor bacteria. The number of recombinants decreased with increasing dose of radiation at a rate corresponding to a sensitive target of volume $1{\cdot}2 \times 10^{-17}$cm.^{3} The frequency of recombinants showing linkage between the threonine and lactose loci also decreased with increasing radiation doses. It is suggested the ionizing radiation causes chromosome breaks in the donor bacterial cell, and that these breaks cause a decrease in the frequency of linked recombinants." [Author's summary].

1195 Mitchell, M. B.
Evidence of non random distribution of ascus classes in fruiting bodies of *Neurospora crassa.*
Genetics 1960 : **45** : 1245–51.

The data from analyses of individual perithecia from an exceptionally fertile *cot* x *pyr* cross provided further evidence that asci formed adjacently in a perithecium may be regularly identical with respect to patterns of segregation of known markers [cf. 26]. While the progenies obtained could be placed in the expected four main phenotypic classes, the differences within a class suggested that the phenotype was arrived at in several different ways, and the possibility is considered of several independently-segregating factors having related and interacting effects on phenotypic expression. The order of spore pairs within an ascus was also found to be nonrandom and is thought to reflect some detail in the mechanism of ascus formation.

1196 Folsome, C. E.
Effects of 5-bromodesoxyuridine upon gene recombination in *Escherichia coli* K-12.
Genetics 1960 : **45** : 1111–22.

Treatment of Hfr donors with 5-bromodesoxyuridine under conditions of thymine starvation increased the time required for markers to enter the untreated recipients, as well as affecting the integration of the genetic material. The treatment apparently resulted in integration of smaller regions of the transferred material. The results are explained on the basis of the partial replica hypothesis of Levinthal and Jacob and Wollman.

1197 Jones, R. M.
Linkage distributions and epistacy in quantitative inheritance.
Heredity 1960 : **15** : 153–59.

"Problems of determining the cumulants of the heritable variation of any generation when linkage and epistacy are both present can be classified according to the number of loci which it is necessary to consider at a time, and among which the linkage relations have to be specified. When this number is greater than three, the recombination frequencies are no longer sufficient to describe the linkage relations, but the system of linkage parameters can be completed by introducing in addition, for every set of an even number of loci, the frequency with which recombination occurs between at least one pair. "The use of Hayman's device in this type of problem is illustrated by obtaining the third cumulant in F_2 when there is no epistacy, a problem of class three. Formulae are given which make possible the solution of any problem of class not greater than four, in any generation obtained by repeated selfing after an initial cross between two inbred lines."
[Author's summary].

1198 Allard, R. W. & Alder, H. L.
The effect of incomplete penetrance on the estimation of recombination values.
Heredity 1960 : **15** : 263–82.

"The consistency and efficiency of linkage estimators that take incomplete penetrance into account are examined theoretically. Introduction of a penetrance parameter, u, does not affect consistency of estimation of p (the linkage parameter) so long as incomplete manifestation $A \rightarrow a$ or $a \rightarrow A$ is equivalent in all genetic phases at the second locus in two point tests. Efficiency of estimation depends on both p and u when penetrance is taken into account. Efficiency is equivalent to that of the usual estimator when $u = 1$ and $p = 0{\cdot}5$, but decreases as p and u tend toward zero.

"The effectiveness of the estimators that take penetrance into account was examined experimentally by applying them to data from four backcross and seven F_2 families in which manifestation was incomplete in seedlings but complete in mature plants. Ignoring incomplete penetrance led to severely biased estimates of linkage intensity for the seedling data. This bias was removed when correction was made for varying degrees of manifestation, but at the expense of information. Nevertheless, the policy of using seedling data was clearly advantageous since the loss in efficiency was more than compensated by the greater expense and effort required to grow plants to maturity.

"The estimators that take incomplete penetrance into account should be particularly useful in linkage experiments involving genes for disease resistance, and in other similar situations where disturbances resulting from failures of manifestation are common and no certain method of achieving complete penetrance is known." [Authors' summary].

1199 Murray, N. E.
The distribution of methionine loci in *Neurospora crassa.*
Heredity 1960 : **15** : 199–206.

"Mutant strains of *Neurospora crassa* requiring methionine or its precursors, were isolated by a filtration concentration technique following ultraviolet irradiation. These and other strains were classified by the tests of precursor utilisation and heterocaryon complementation into seven groups of cysteine and eight groups of methionine mutant strains.

"The methionine strains represent genes at eight different loci; of these three had been located previously and four of the remainder were assigned to definite regions of the linkage maps. No evidence for tight clustering of either the methionine or cysteine genes was obtained.

"Inter-allelic complementation was demonstrated for two of the methionine genes." [Author's summary].

1200 Murray, N. E.
Complementation and recombination between *methionine*-2 alleles in *Neurospora crassa.*
Heredity 1960 : **15** : 207–17.

"Amongst 44 *methionine*-2 strains of *Neurospora crassa*, twelve have been demonstrated to be capable of interallelic complementation. Genetic and complementation maps have been constructed. The use of marker genes on either side of the *me*-2 locus has facilitated the demonstration of interallelic crossing-over and conversion. These studies also indicate a linear arrangement of mutable sites within the gene, with additive prototroph frequencies, to yield a map which can be correlated with a complementation map. Growth assays suggest that there is no correlation between the degree of complementation and the distance between two mutant sites. Evidence is provided that some alleles have higher conversion rates than others." [Author's summary].

1201 Taylor, A. L. & Adelberg, E. A.
Linkage analysis with very high frequency males of *Escherichia coli.*
Genetics 1960 : **45** : 1233–43.

Three new Hfr (male) strains of *E. coli* which transfer the entire male genome to females at relatively high frequency are described. The term Vhf (very high frequency) males is proposed to distinguish these from ordinary Hfr strains. Studies with the Vhf males provided evidence in support of the Jacob-Wollman theory of a closed (circular) linkage group for *E. coli* 'K–12' [XXVIII, 1130]. In particular, evidence for linkage from *mal* through *arg* to TL is provided, and a corrected genetic map showing the relative distances between markers as determined by kinetic experiments is presented. The use of Vhf males for precise mapping of markers and for rapid location of new mutant loci is discussed.

1202 Gross, S. R. & Fein, A.
Linkage and function in *Neurospora.*
Genetics 1960 : **45** : 885–904.

"The genetic and physiological properties of several *arom* mutant strains of Neurospora are described. The most likely interpretation of the evidence presented is that the genes responsible for the production of at least four enzymes involved in the synthesis of the aromatic ring are closely linked in linkage group II. Another gene involved in the same reaction sequence, while also on linkage group II, is loosely linked to the others. The inability of *arom*–2 *Ab* to carry out four reactions in the sequence appears to be due to an aberration in the *arom*–1 and *arom*–4 region of linkage group II.

"The problem of linked genes controlling related physiological reactions has been discussed in terms of the involvement of common control mechanisms for protein synthesis.

"Autoinduced enzyme synthesis is proposed as the mechanism leading to the appearance of two enzymes, as part of the constitutive enzymatic complement of *arom*–1, *arom*–3 and *arom*–4, that are present, if at all, only in extremely low concentrations in *arom*–2 *Ab* and the standard strains." [Authors' summary].

1203 Streisinger, G. & Bruce, V.
Linkage of genetic markers in phages T2 and T4.
Genetics 1960 : **45** : 1289–96.

Sensitive tests of linkage indicated that the known genetic markers of phages T2 and T4 are arranged in one linkage group as in the smaller phages.

1204 Sybenga, J.
Non-random distribution of chiasmata in rye, *Crotalaria* and coffee.
Chromosoma 1960 : **11** : 441–55.

Formulae are presented for testing the randomness of the distribution of the bound arms of bivalents which contain at least one chiasma, assuming that the probability of being bound depends on the arm length. The distribution was found to be nonrandom in *Secale cereale*, *Crotalaria intermedia* and species of *Coffea*, there being an excess of bivalents with only one arm bound. In rye plants homozygous for a large translocation, an excess of univalents occurred and this is attributed to the low probability of the newly formed short arm of the small translocation chromosome being bound.

1205 Maguire, M. P.

The relation of reduplication, recombination, synapsis and chromosome coiling.

Genet. Res. 1960 : **1** : 487–88.

The purpose of this note is to suggest an alternative hypothesis to that put forward by Pritchard [cf. XXX, 2193] to account for localized negative interference. It has already been suggested by the author that synapsis usually may be completed during interphase and that partially paired chromosomes at the stage traditionally referred to as zygotene may represent premature dissociation in slightly unbalanced cells [cf. 403]. It seems probable however that the chromosomes are somewhat coiled at whatever stage crossing over occurs. Consecutive homologous points may thus establish intimate contact only for short segments along their length, although on a grosser level homologous chromosomes may be completely paired. Slight differences between homologues in pitch and diameter of internal coiling, or minute differences in position of matching points and various modes of twisting of the chromosomes about one another, might result in a drastic reduction in the frequency of effective pairing and in a more or less random distribution of these pairing regions throughout the complement in different cells.

1206 Papazian, H. P.

Cluster model of crossing over.

Genetics 1960 : **45** : 1169–75.

"The consequences of a theory of crossing over in which crossovers occur in tight clusters is examined. Formulas relating recombination, quadruplet, and chiasmata frequencies are developed and parameters roughly estimated from published data." [Author's summary].

1207 Elliott, C. G.

Non-localised negative interference in *Aspergillus nidulans*.

Heredity 1960 : **15** : 247–62.

Two populations of *A. nidulans* were crossed at three temperatures. For each temperature, the incidence of recombination was measured in a random sample of ascospores, referred to as the unselected sample and in a selected sample of spores, showing recombination in a short segment, or selective region. The regions measured comprised two adjacent to the selective region, a further region on the same chromosome and one on a different chromosome.

The results obtained are interpreted as being the result of the following: (*a*) a nonrandom distribution of exchanges within short, effectively paired segments; (*b*) a weak, positive correlation between exchanges throughout the nucleus, the deviation from a random distribution increasing with increasing temperature; and (*c*) nonrandom distribution of exchanges among long segments of one chromosome, the distribution of exchanges in double cross overs being different at different temperatures.

"In another cross, the incidence of recombination in selected samples of cross-overs between *loosely* linked markers was likewise greater than in unselected samples. The difference in map length between the two samples was inversely related to the length of the selective region."

1208 Strickland, W. N.

Interference in short chromosome segments of *Neurospora*.

Genetics 1960 : **45** : p. 1014. (Abst.).

In most organisms chiasma interference is positive when intervals are short but the situation with respect to chromatid interference is not clear. The present study was designed to test for chromatid interference across intervals which were sufficiently short to avoid the confusion caused by multiple exchanges within an interval but long enough for a reasonable number of multiple exchanges over the marked region. Use was made of the centromere-independent group-V markers *hist*-1 - 5 - *inos* - 5 - *bis* - 10 *pab*-2. Chiasma interference was very strong in all crosses. Some parental combinations, but not others, gave evidence of chromatid interference. Different types of chromatid interference were detected according to the parental combination and the distance between the exchanges.

1209 Barricelli, N. A. & Doermann, A. H.

An analytical approach to the problems of phage recombination and reproduction. II. High negative interference.

Virology 1960 : **11** : 136–55.

A mathematical theory based on the switch hypothesis [cf. XXIX, 1773] has been developed which enables high negative interference to be taken into account when crosses and related phenomena involving more than two closely linked genetic markers are being analysed. Partial replica models of a fairly general type can account at least qualitatively for some high negative interference phenomena. Also these models can be used for predicting phenomena such as "(1) the induction of a switch area by infection with partial heterozygotes; (2) clonality of recombinants of a different type and with different characteristics than the one resulting from duplication of a recombined genome; (3) clonality of heterozygotes; (4) triparental high negative interference".

1210 Gay, P. A.
A new method for the comparison of populations that contain hybrids.
New Phytol. 1960 : **59** : 218–26.

The method outlined, which is based upon Anderson's technique of hybrid indices, eliminates some of the subjective element inherent in that technique and makes it possible to summarize data on complex populations by two statistics. The method was devised during a study of the phytogeography of *Erica ciliaris,* which hybridizes with *E. tetralix.*

1211 Hayman, B. I.
Heterosis and quantitative inheritance.
Heredity 1960 : **15** : 324–27.

Williams' criticism [cf. XXX, 996] of the gene-interaction explanation of hybrid vigour is subjected to critical analysis. The relative significance of genetic and somatic factors in explaining tomato yield data is discussed. It is suggested that "to restore precision to the concepts of gene action and interaction we can hardly do better than to ignore somatics and to return to genetics alone". Williams' alleged imprecision in the use of the terms independent (as in "completely independent genetic units") and additive (as in "essentially additive genetic system") is commented upon.

1212 Williams, W.
Heterosis and the genetics of complex characters.
Heredity 1960 : **15** : 327–28.

It is claimed that data on tomato yield [cf. XXX, 996] may "be described very adequately and simply by consideration of somatic interaction superimposed on the genetic system". Direct observations on the phenotype may simplify the study of heterosis and may assist in the solution of practical problems connected with the selection of parents and prediction of breeding performance.

1213 Turbin, N. V. & Vahtin, Ju. B.
(Darwinism and genetic theories of heterosis).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1959 : **64** : 131–40 [Russian].

The history of hybrid maize in America is traced back to Beal, a pupil of Asa Gray and a follower of Darwin. The overdominance hypothesis is explained and a number of cases of overdominance in various organisms are cited. The production of double-cross hybrids equal in heterosis to the single crosses from which they arose is regarded as evidence in favour of overdominance, as is also the limited success of the method of convergent improvement based on the dominance hypothesis. The presence of recessive genes which in the homozygous state are deleterious or lethal is considered necessary for the retention of the necessary degree of adaptive capacity in any population; removal of such genes from various rye varieties by inbreeding did not lead to any improvement in yielding ability. The expression of heterosis varies according to the environment and the genetic milieu; many aspects of the phenomenon still await an adequate explanation but Darwin's view that hybrid vigour was evolved by the hereditary diversity of the parental gametes is regarded as the most suitable basis for a general interpretation.

1214 van Arkel, G. A.
Het verband tussen genstructuur en genfunctie. **(The relation between gene structure and gene function).**
Meded. Dir. Tuinb. 1960 : **23** : 674–83.

Topics referred to in this short survey include recombination and gene mapping in microorganisms, the genetic units muton, recon and cistron, the structure of DNA, the relation of gene specificity to nucleotide order in DNA, and the probability that point mutations may arise through substitution of one nucleotide for another or through some other disturbance of the nucleotide order.

1215 Pateman, J. A.
Inter-relationships of alleles at the *am* locus in *Neurospora crassa.*
J. gen. Microbiol. 1960 : **23** : 393–99.

Twelve mutant alleles induced at the complex locus *am* for production of glutamic dehydrogenase may be distinguished with respect to at least one of the following criteria: back mutation, recombination, complementation and type of glutamic dehydrogenase formed by back mutants [cf. XXIX, 47]. The data on complementation are at variance with the cistron concept, most of the possible combinations of alleles being noncomplementary. It is regarded as unlikely that the mutations in question are deletions, an assumption necessary to fit the cistron hypothesis. Either the complementary relationships between alleles represent, it is suggested, a nonlinear aspect of the locus, or some of the mutations occur at sites especially critical for the production of an integrated gene product, in this case presumably glutamic dehydrogenase. The author regards the latter alternative as the most probable.

1216 Wahl, R., Huppert, J. & Emerique-Blum, L.
Production de phages par des "protoplastes" bactériens infectés par des préparations d'acide désoxyribonucléique. **(The production of phages from bacterial "protoplasts" infected with preparations of deoxyribonucleic acid).**
CR Acad. Sci., Paris 1960 : **250** : 4227–29.

The nucleic acids of *Shigella paradysenteriae* infected with phage Φ X 174 were extracted and incubated together with "protoplasts" of *S. paradysenteriae*, prepared by means of lysozyme and versene, and were found, on being plated out with susceptible bacteria, to form centres of infection. The activity of the extracts was resistant to the action of trypsin, RNase and heat but was destroyed by DNase, indicating that DNA itself is responsible for the infective activity and that protein factors probably do not play a part.

1217 Barricelli, N. A.
An analytical approach to the problems of phage recombination and reproduction. I. Multiplicity reactivation and the nature of radiation damages.
Virology 1960 : **11** : 99–135.

Multiplicity reactivation data from various sources are considered. Some of the results indicate that the length of radiation-induced damages does not reflect the size of elementary genetic structures but only the length of segments of genetic material affected by radiation. The A and B cistrons in the ^{r}II region are vulnerable centres in K12 (λ)-T4 complexes. Possible models for phage reproduction and recombination are discussed and the mathematical theory for the distribution of damaged areas and undamaged areas in a phage genome has been developed and applied to a calculation of the minimum frequency of recombination needed for multiplicity reactivation in a bicomplex.

1218 Imșenețki [Imšeneckij], A. A., Perova, K. Z., Zaițeva [Zajceva], T. A. & Belozerski [Belozerskij], A. N.
Transmiterea streptomicinorezistenței la stafilococ cu ajutorul acidului dezoxiribonucleic. **(The transmission of streptomycin resistance in staphylococci by means of deoxyribonucleic acid).**
An. Romîno-Soviet. : Ser. Biol. 1959 : **13** : No. 4 : 39–44.

[Cf. XXX, 1039].

1219 Arber, W.
Transduction of chromosomal genes and episomes in *Escherichia coli.*
Virology 1960 : **11** : 273–88.

"The relationship between transfer of bacterial markers and stable transduction in *Escherichia coli* K12 by phage P1 is studied. For the gene regions examined, transfer frequencies of the order of 10^{-5} to 10^{-4} per normal P1 phage are found, whereas stable transductants are detected only at 10 to 100 times lower frequencies. The fertility factor F and prophage λ, both known to be episomes, are transferred at similar rates. Ultraviolet (UV) irradiation of the transducing lysate increases the frequency of stable transductants for chromosomal genes, but does not increase the detected rate of transfer of the episomes. The UV survival of the episomes decreases exponentially: the survival of λ prophage corresponds to the UV survival of free λ; F shows a UV sensitivity comparable with those of phage genomes. The detection techniques used reveal functions of transferred episomes without requiring their integration into the chromosomal structure of the recipient cell: a transferred F factor converts the acceptor into a male, itself capable of converting the whole F^- culture and a transferred prophage λ gives transfer induction, except in rare cases of stable integration leading to lysogeny."

[Author's summary].

1220 Hofschneider, P. H.
Über ein infektiöses Desoxyribonucleinsäure-Agens aus dem Phagen ΦX174. **(On an infectious desoxyribonucleic acid agent from the phage ΦX174).**
Z. Naturf. 1960 : **15b** : 441–44.

By means of phenol extraction of ΦX174

bacteriophage, a substance was obtained which was infective towards *Escherichia coli*, *E. coli* 'B' and spheroplasts of *E. coli* 'B' and *E. coli* 'C' prepared with lysozyme and ethylene-diamine-tetraacetic acid. It differed from intact phage in its DNase susceptibility, its different host range and its greater temperature stability. The presence of a protein component was not demonstrated.

1221 Alihanjan, S. I. & Il'ina, T. S.
(Transduction and mutagenesis in *Actinomyces* under the action of actinophages).
Ž. obšč. Biol. (J. gen. Biol.), Moskva 1959 : **20** : 269–75. [Russian].

Auxotrophic strains of *Actinomyces* (*Streptomyces*) *olivaceus* deficient for cysteine, tyrosine, methionine or histidine gave rise to prototrophs when infected with a phage which had been grown on a prototrophic strain. The phage cultured on a streptomycin-producing strain of *A. globisporus* transferred the ability to synthesize streptomycin to a strain of *A. olivaceus* which has previously lacked this ability.

1222 Campbell, A.
Ordering of genetic sites in bacteriophage λ by the use of galactose-transducing defective phages.
Virology 1959 : **9** : 293–305.

"In the transduction of galactose genes by bacteriophage λ, each transducing particle is characterized by the effective absence of an interstitial region of genetic material. The exact position of one of the end points of this region is different for particles arising from different primary events but appears never to change during subsequent multiplication. From this it is concluded that the transducing particle probably does not arise by crossing over within a region of full homology between phage and bacterial genomes." [Author's summary].

1223 Szybalski, W., Opara-Kubinska, Z. & Lorkiewicz, Z.
Transforming activity of deoxyribonucleic acid labelled with 5-bromouracil.
Nature, Lond. 1960 : **188** : 743–45.

As indicated by the behaviour of three genetic markers, DNA molecules of *Bacillus subtilis* retained their transforming activity even after 5-bromouracil had been substituted for thymine in one strand or both strands of the double helix.

1224 Imšeneckij, A. A. & Perova, K. Z.
(Transformations induced by extracts having no cellular structure).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 505–11. [Russian].

A *Staphylococcus aureus* strain with only one streptomycin-resistant cell in 0.25·10^9 to 0.65·10^9 cells gave rise to resistant strains on culturing in a meat-peptone broth to which a cell extract from a strain experimentally adapted to streptomycin had been added. The transformation is ascribed to the DNA of the extract.

1225 Imšeneckij, A. A. & Perova, K. Z.
(Transformations induced in microorganisms by filtrates passed through bacterial filters).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 673–78. [Russian].

A culture of *Staphylococcus* normally susceptible to streptomycin gave rise to resistant forms on being cultured in a broth to which filtrates through an L$_3$ Chamberlain candle or asbestos CF filter had been added.

1226 Pakuła, R., Hulanicka-Bańkowska, E. & Walczak, W.
Photoreactivation of UV damaged streptomycin resistance marker in transforming DNA of streptococci and pneumococci.
Bull. Acad. polon. Sci. : Sér. Sci. Biol. 1960 : **8** : 269–74.

It has been found by Goodgal *et al.* that the genetic activity of ultraviolet-damaged DNA of *Haemophilus influenzae* cannot be restored by visible light except in the presence of an *Escherichia coli* extract. In the present experiments, similar extracts had a strongly inhibitory effect upon transformation in streptococci and pneumococci and only with some extracts was a slight but distinct photoreactivation effect of the above kind observed.

1227 Beale, G. H.
The role of cytoplasm in inheritance.
Sci. Progr., Lond. 1961 : **49** : No. 193 : 17–35.

The author reviews a selected assortment of examples of cytoplasmic inheritance drawn from higher and lower plants and animals, and gives a generalized evaluation of the significance of this phenomenon in heredity at the levels of the single cell and multicellular organism.

1228 Stinson, H. T. (Jun.)

An alteration leading to change of a species-specific characteristic of the Oenothera chloroplast.

Genetics 1960 : **45** : p. 1013. (Abst.).

Plastid mutations so far encountered in *Oenothera* have been to defective, nongreen plastids. An alteration in which one plastid type has undergone spontaneous modification to another in at least one characteristic is reported; mutation in an extranuclear component appeared to be responsible.

1229 Lagervall, P. M.

Quantitative inheritance and dominance. I. The coefficient of relationship caused by dominance.

Hereditas, Lund 1960 : **46** : 481–96.

A general formula is given for the coefficient of relationship caused by dominance between two individuals drawn from (1) a randomly mating and (2) an inbreeding population. Simplifications are given for the following special cases: (1) individuals related as ancestor and descendant; (2) individuals related collaterally; and (3) individuals related as ancestor and descendant and collaterally. The dominance coefficient is often, but not always, a function of its inbreeding coefficients.

1230 Bodmer, W. F. & Parsons, P. A.

The initial progress of new genes with various genetic systems.

Heredity 1960 : **15** : 283–99.

"1. The conditions for the establishment of a newly occurring gene in a population are discussed for three genetic systems; namely the introduction of a third allele into a two allele balanced polymorphism, a random mating tetrasomic population with and without double reduction, and a diploid population in which there is mixed selfing and random mating.

"2. In an outbreeding population some heterozygote advantage is essential for a new gene to become established in a population, but with some inbreeding this is no longer a prerequisite.

"3. Available evidence appears to favour the possibility of the selective modification of the heterozygote fitness during the course of the establishment and spread of a new gene in an outbreeding population."

[Authors' summary].

1231 van der Veen, J. H.

Heterozygote superiority, selection intensity and plateauing.

Heredity 1960 : **15** : 321–23.

A population is considered in which (1) "certain heterozygotes are preferred to any homozygote arising from the gene pool in other than negligible quantities", (2) environmental variation is absent, (3) after mass selection random mating is practised, (4) random drift can be neglected, and (5) no selective forces are acting save the one intentionally applied to the metric character considered. Then, if p is the relative frequency of the plus allele A, and v is selection intensity, a stable equilibrium is reached at $p = v$ for $v \geqslant \frac{1}{2}$, or at $p = \frac{1}{2}$ for $v \leqslant \frac{1}{2}$. Therefore, if v is larger or smaller than the population maximum, the ultimate plateau will fall short of this, and, in fact, the maximum will be approached closer by relaxed selection than by intense selection.

1232 Griffing, B.

Theoretical consequences of truncation selection based on the individual phenotype.

Aust. J. biol. Sci. 1960 : **13** : 307–43.

The cases considered are: (1) a single locus with n alleles; (2) the gamete level simplified to two linked loci; and the individual as specified by the combining gametes. Truncated selection, an infinite population, small individual effects of the genes and equal reproductive value of all selected genotypes are assumed. General mathematical analyses of truncated selection are made for each of the above cases and a detailed study is made of the effect of selection and subsequent relaxation for the 2-locus case. It is shown that additive x additive epistasis may alter the response to selection expected on the basis of the 1-locus analysis, but that, on relaxation, the population mean decays to the value predicted in the latter case.

1233 Ishikawa, T.

Complementation and genetic maps of *ad-8* locus in *Neurospora crassa*.

Genetics 1960 : **45** : p. 993. (Abst.).

A new group of adenine-requiring mutants has been identified at locus *ad*–8, 26 map units to the left of the centromere in linkage group VI. So far, 242 primary and 64 secondary *ad*–8 mutants have been isolated. Blocked in the conversion of inosine monophosphate to adenosine monophosphate succinate, the mutants lack adenylosuccinate synthetase activity. One hundred and six of the primary mutants and 19 of the secondaries gave a positive heterocaryon response with at least one other group of alleles. The complementation patterns were indicative of three distinct functional units. Interallelic crosses involving 65 primary and secondary mutants showed the locus to be composed of at least 19 mutational sites arranged linearly and the intersite distances to be generally additive. Total map distance was estimated to be 0·09%. In some cases, more than one site was involved in the mutational event. A number of the secondary mutations appeared to be situated at the same site as the primary ones. With several exceptions, the complementation and genetic maps corresponded.

1234 MURRAY, N. E.

Complementation and recombination studies on me-2 alleles of *Neurospora crassa.*

Genetics 1960 : **45** : p. 1002. (Abst.).

Interallelic complementation has been established for 12 of 44 methionine-requiring *me*–2 mutants. According to the complementation map, the locus may be divided into four physiological subunits. Use of marker genes on either side of *me*–2 facilitated demonstration of interallelic recombination by crossing over and by conversion. A sample of alleles, chosen to represent the different complementation classes, was assigned to a linear arrangement on the basis of both interallelic crossing over and total prototroph frequencies. The data are consistent with a linear order of mutable sites within the locus, and suggest that the four physiological subunits may be translated into linear segments of the genetic map. No correlation was found between degree of complementation, as judged by growth assays, and distance between the two mutant sites. Some alleles had high rates of conversion and others low rates.

1235 MORSE, M. L.

Mapping studies of galactose mutants of *Escherichia coli* K-12.

Genetics 1960 : **45** : p. 1001. (Abst.).

"Certain combinations of the galactose-negative mutants of *E. coli* in heterogenotes show position effect, i.e. they are mutant in the *trans*-position (+ —/— +) and nonmutant in the *cis*-position (— —/+ +). During growth, recombination occurs in *trans*-position heterogenotes to yield nonmutant *cis*-position heterogenotes. Quantitative study of clones of *trans*-position heterogenotes yields data which can be used to compute "crossover" probabilities between two mutant sites showing position effect. "Crossover" probabilities have been computed for a number of mutant pairs (by the mutation rate estimate methods of Luria and Delbruck) and found to be between 0·047–5·8 × 10^{-4} per bacterium per division. Three distinct mutant sites (each of which shows position effect with the others) studied by transducing from single mutant donors to double mutant recipients in all possible combinations ($a^-b^+c^+$ — x $a^+b^-c^-$; $a^+b^-c^+$ — x $a^-b^+c^-$; $a^+b^+c^-$ — x $a^-b^-c^+$) will qualitatively indicate the order of mutant sites, for one combination (+—+/—+—) will require double crossing over (p about 10^{-8}) to yield nonmutant recombinants (+++). The double mutants necessary for this three point test are obtained as recombinants issuing from heterogenotes containing two mutant sites. The *Gal*$^-$ mutants of *E. coli* isolated previously and new mutants, spontaneously derived and induced by various mutagens, are being mapped by the two point and three point methods outlined above." [Cf. XXX, 1001].

1236 NAKADA, D.

Mutation and the replication of DNA.

Genetics 1960 : **45** : p. 1002. (Abst.).

"By the use of chloramphenicol and a thymineless mutant of *E. coli*, it was shown that protein synthesis was a prerequisite for the replication of DNA. A residual increase in DNA of 30–50 per cent, unaccompanied by protein synthesis, occurs within a few hours of the starvation of an auxotroph for the amino acid it requires. Thereafter the DNA content of the starved population decreases, and after ten days density gradient centrifugation yields no evidence for DNA replication. Nonetheless, during the interval spontaneous mutations take place at a constant rate. The possibility that infrequent exchange reactions occur is under consideration. In contrast, it has been shown that 2-aminopurine will induce mutations in *Salmonella typhimurium* only while DNA is replicating."

1237 RUDNER, R.

Mutation as an error in base pairing.

Genetics 1960 : **45** : p. 1008. (Abst.).

Base analogues and nitrous acid were used as mutagens in studying locus *try*D of *Salmonella typhimurium*, at which 11 sites have mutated to a condition responsible for auxotrophy. The sites reacted differently, some being unresponsive, whereas others reacted to one or more of the mutagens and in different degrees. The mutants appeared in a pattern determined by DNA replication and consistent with the view that the analogue in question, 2-aminopurine, was incorporated during replication and rarely chose an erroneous base upon subsequent replication. This correspondence with the hypothesis was found whether 2-aminopurine was present continuously or only during the first replication, and when the cells were allowed to replicate their DNA without cell division. [Cf. XXX, 3440].

1238 REISSIG, J. L.
Forward and back mutation in the *pyr3* region of *Neurospora*. I. Mutations from arginine dependence to prototrophy.
Genet. Res. 1960 : **1** : 356–74.

A system for screening of mutations in both the forward and backward directions has been developed, *arg*2 being suppressed by *pyr*3 for pyrimidine dependence. Prototrophs obtained after treating the *arg*2 mutant with ultraviolet rays and plating on a medium free from arginine or pyrimidines arose in one of three ways: (1) back mutation of *arg*2; (2) forward mutation from $pyr3^{+}$ to *pyr*3, interaction with the unmutated nuclei of the same macroconidium permitting growth on a minimal medium; or (3) forward mutation from $pyr3^{+}$ to $pyr3^{su-arg}$, an allele suppressing *arg*2 but not causing a pyrimidine requirement.

1239 YANOFSKY, C.
The tryptophan synthetase system.
Bact. Rev. 1960 : **24** : 221–45.

Mutation studies with the tryptophane synthetase system of *Neurospora crassa* and *Escherichia coli* are described.

1240 STUBBE, H.
Some results and problems of theoretical and applied mutation research.
Indian J. Genet. 1959 : **19** : 13–29.

Mutation investigations at the Institute for Research on Cultivated Plants at Gatersleben, East Germany, are reported. These studies on barley [cf. XXIX, 1096 and XXX, 2665], soya bean [XXVII, 3582], fruit trees [XXX, 3076] and alkaloid plants [XXVIII, 1834] have already been summarized.

Chemische Mutagenese. Erwin-Baur-Gedächtnisvorlesungen I 1959. Veranstaltet vom Institut für Kulturpflanzenforschung Gatersleben der Deutschen Akademie der Wissenschaften zu Berlin 26.–28. Juli 1959. (**Chemical mutagenesis. Lectures in memory of Erwin Baur I, 1959 organized by the Institute for Research on Cultivated Plants, Gatersleben, of the German Academy of Sciences at Berlin 26-28 July 1959**).
Akademie Verlag, Berlin 1960 : DM 18.50 : Pp. vi + 136 : figs. : tables.

On the occasion of the 25th anniversary of the death of Erwin Baur, the German Academy of Sciences of Berlin decided to hold symposia in his memory every two or three years at Gatersleben. This volume consists of papers read at the first symposium and those of possible interest to readers of *Plant Breeding Abstracts* are summarized below.

1241 *Gustafsson, Å. Chemical mutagenesis in higher plants.* (*pp. 14–29*).

Among the topics discussed in this review are the following: types and rates of chemically induced mutations; mutation spectra and controlled mutagenesis; the origin of erectoid mutations in barley; and possibilities of inducing mildew resistance in barley by mutation. Particular reference is made to recent studies by Favret [cf. XXX, 3750 and 3947] and Hagberg [XXXI, 149].

1242 *Westergaard, M. Chemical mutagenesis as a tool in macromolecular genetics.* (*pp. 30–44*).

The author presents eight specifications for studies in experimental mutagenesis and discusses each in turn with reference to recent developments and future possibilities. One of these specifications, on which particular stress is laid, is the need to work with species on different evolutionary levels of organization. A number of differences in the genetic mechanisms of bacteria and higher organisms are reviewed. The author proposes a hypothesis, whereby a "naked" nucleic acid chromosome is regarded as the information-carrying structure in bacteria and viruses, and the "nucleoprotein chromosome" as the information-carrying structure in higher organisms. The range of mutagenic agents is reviewed; recent studies on base-specific and alkylating agents are noted.

It is suggested that the closest approximation to a mutation system which corresponds with the suggested specifications is represented by the work of Benzer [XXVIII, 3708] and Freese [XXIX, 3406] on the rII system in phages of *Escherichia coli*.

1243 *Revell, S. H. Some implications of a new interpretation of chromatid aberrations induced by ionizing radiations and chemical agents.* (*pp. 45–46*).

Further implications are presented of the hypothesis that chromatid exchange, rather than breakage and reunion, is responsible for chromatid aberration. [Cf. XXIV, 1624].

In root meristem cells of *Vicia faba*, the stage just before the beginning of prophase is the latest one at which X rays can induce chromatid exchanges to appear at the following metaphase. It is thus possible that "the exchange process which must be envisaged is developmentally homologous with the meiotic one".

Single ionizing particles, or chemical agents at a low concentration, can perhaps be regarded as the initiators of exchange, the exchange itself being a subsequent chromosome development possibly akin to meiotic exchange. According to this conception, both the primary event and exchange initiation could be of very small magnitude in terms of chemical change, though they would be subject to amplification by subsequent chromosome development.

If the exchange interpretation is correct, the spatial arrangement of chromosomes in the resting nucleus would be an important factor affecting sensitivity to the induction of all types of chromatid aberration. The hypothesis thus appears to offer greater scope in accounting for large differences in sensitivity, so far as the induction of chromatid aberrations is concerned. During the "post-split" stage when chromatid changes are initiated, the chromosomes need not be differentiated into chromatids; "it is thus not necessary to assume that the primary events take place in the chromatids which are finally observed to be exchanged".

1244 *Ockey, C. H. Chromatid aberrations induced by ethyleneimines. (pp. 47–53).*

Triethylene melamine was applied at a concentration of 1 x 10^{-4} molar for 1 hr. to root tips of *Vicia faba*. Cytological observations on the effects were made after varying recovery periods. After 12 hr., about 10% of the cells showed aberrations, including a high proportion of type 4 (sister union) intrachanges but only few interchanges. With longer recovery time, the number of intrachanges decreased while the interchanges increased. At 12–16 hr. after treatment, aberrations were localized in positively heterochromatic segments but became less so with increase in recovery time. Chromosome 5 was involved far more frequently at the early periods than later, while chromosome 1 was involved more at the later times. These changes in time are interpreted in terms of increase in nuclear size, variations in contact between and within chromosomes during interphase, and differences in the amount of uncoiling in positive heterochromatin and euchromatin.

1245 *Rieger, R. & Michaelis, A. Über die radiomimetische Wirkung von Äthylalkohol bei* Vicia faba. (*The radiomimetic action of ethyl alcohol in* V. faba). (*pp. 54–65*).

Some of the results mentioned here have been reported elsewhere [cf. XXX, 94 and 96]. The aberrations were entirely of the chromatid type; both isolocus breaks and chromatid translocations showed an almost linear increase with dose of ethyl alcohol up to a concentration of 10^{-1}M and it seems that both types of aberration are induced by a similar process. Aberrations were induced during the first part of interphase; the aberration rate increased with rising temperature up to 30° C. and then dropped. Combined treatment with 10^{-1}M ethyl alcohol and 10^{-2}M 2,4-dinitrophenol for 24 hr. resulted in a significant reduction in radiomimetic effect and under anoxia it was completely suppressed. It is thought that some oxidative processes are involved in the induction of mutations by ethyl alcohol. Possible modes of action are considered and it is suggested that ethyl alcohol acts by denaturing certain proteins. Ethyl alcohol may be involved in spontaneous mutagenesis.

1246 *Loveless, A. Some observations on the interaction between alkylating agents and phage and their relevance to problems of chemical mutagenesis. (pp. 71–75).*

Difficulties in making quantitative comparisons of the efficiency of different alkylating agents as mutagens are discussed. As regards qualitative differences, a number of results from a study of the inactivation of phage by such agents has revealed useful information. In particular, it appears that specificity of mutational activity derives not from specificity on the part of either the mutagen or the sensitive site, but from the properties of the primary reaction product.

It was observed that the modification of phage DNA following alkylation occurred only when the DNA was in a tightly coiled state. It is suggested that geometrical configuration may have some relevance to the problem of specificity of alkylating agents. The advantages of ethylmethane sulphonate over other alkylating agents used in mutagenesis are discussed briefly. Results obtained from studies with this compound indicate that a common mode of action should be sought in viruses, bacteria and higher organisms, a view somewhat at variance with that expressed by Westergaard [cf. 1254].

1247 *Schuster, H., Gierer, A. & Mundry, K. W. Inaktivierende und mutagene Wirkung der chemischen Veränderung von Nucleotiden in Virus-Nucleinsäure. (Inactivating and mutagenic action of the chemical alteration of nucleotides in virus nucleic acid). (pp. 76–85).*

Experiments on the deamination of bases in the RNA strand of the tobacco mosaic virus are discussed [cf. XXIX, 1206].

1248 *Kaudewitz, F. Inaktivierung und Mutagenese von* Escherichia coli *durch Inkubation mit Natriumnitrit.* (*Inactivation and mutagenesis of* E. coli *by incubation with sodium nitrite*). (*pp. 86–91*).
Some of the studies mentioned here have been described elsewhere [cf. XXX, 69 and 70]. It is now thought that the production of mutants follows a one-hit curve instead of a two-hit curve.

1249 *Vielmetter, W., Schuster, H. & Wieder, C. M. Inaktivierende und mutagene Wirkung salpetriger Säure auf Phagen.* (*Inactivating and mutagenic effect of nitrous acid on phages*). (*pp. 92–97*).
Results reported elsewhere are mentioned [cf. XXIX, 3420] and some additional experiments are described. The action of nitrous acid seems to involve deamination of DNA bases.

1250 *Heslot, H.* Schizosaccharomyces pombe: *un nouvel organisme pour l'étude de la mutagenèse chimique.* (S. pombe: *a new organism for the study of chemical mutagenesis*). (*pp. 98–105*).
The organism may be of value in clarifying two critical problems of mutagenesis: the relationship between the molecular structure of a compound and its mutagenic activity; and the question as to whether "intergenic" specificity exists. Studies on reverse mutation in a number of biochemical mutants of *S. pombe* were carried out; the results showed a linear relationship between the concentration of the mutagenic agent and the number of reversions per 10^7 surviving cells. The curve describing this relationship became exponential when very high concentrations of the mutagen were applied. It is thought that it may be possible to define for each substance an index of specific activity, for example, the molecular concentration capable of inducing 1000 reversions per 10^7 surviving cells. Regarding the second problem, the influence of four mutagens on the genes (*ad*–1, *ad*–2, . . . *ad*–8) controlling the synthesis of adenine was studied. The results indicated the probable existence of intergenic specificity.

1251 *Heslot, H. Action d'agents chimiques mutagènes sur quelques plantes cultivées.* (*Action of chemical mutagenic agents on some cultivated plants*). (*pp. 106–08*).
Details are given of chimeras induced in the leaves and stems of lettuce plants, through the action of ethyl sulphate, ethylene oxide and ethylmethane sulphonate. The last-named compound showed particular promise for use as a mutagenic agent in cultivated plants.

1252 *Heslot, H. Note sur l'activité mutagène de certains antifoliques.* (*A note on the mutagenic activity of certain antifolic substances*). (*p. 109*).
Aminopterin and methotrexate were found to be capable of inducing white mutants in a red strain of *Schizosaccharomyces pombe.*

1253 *Györffy, B. Die Wirkung einiger chemischer Mutagene auf* Xanthomonas phaseoli *var.* fuscans. (*The effect of some chemical mutagens on* X. phaseoli *var.* fuscans). (*pp. 110–15*).
Data are provided on the effect of a series of chemicals on the frequency of mutants resistant to streptomycin and phage; some chemicals, e.g. ethanolamine, reduced the frequency of streptomycin-resistant mutants whilst others, e.g. caffeine and imidazol-4,5-dicarboxylic acid, caused a marked increase. These results indicate that changes in nucleic acid metabolism influence the phenotypic expression of resistance. It has been found that complete resistance to streptomycin can arise in one step or be attained gradually by a series of mutations. Phage-resistant variations arise so frequently in culture that it is difficult to determine whether chemicals have a true mutagenic effect on phage resistance.
The effects of some cytostatic sugar derivatives is described; the action of these substances on cells pretreated with mutagenic agents is being studied.

1254 *Auerbach, C. & Westergaard, M. A discussion of mutagenic specificity.* (*pp. 116–23*).
Westergaard discusses specificity on the "geographical" level and deals with interlocus and intralocus specificity, specificity on the chromosomal level, and specificity with respect to degree of damage. Auerbach, in an analysis of specificity on the "functional" level, deals with each of the stages in the mutagenic process, pointing out that specificity may occur at any one of these.

1255 *Ehrenberg, L. Chemical mutagenesis: biochemical and chemical points of view on mechanisms of action.* (*pp. 124–36*).
The mode of action, specificity and significance of the chemical agents currently used in mutagenesis studies are reviewed. The directions in

which future studies may be expected to proceed are briefly discussed.

1256 Cavalloro, R.
L'utilisation agronomique de la mutagenèse artificielle. Résultats et perspectives. (**The agronomic utilization of artificial mutagenesis. Results and prospects).**
Tabacco, Roma 1960 : **64** : 268–90.

Studies on physical and chemical mutagenic agents, their relative efficiency in the induction of mutations, and results obtained from mutagenic investigations on cultivated plants, are dealt with in this review.

1257 Bálint, A.
Sugárzásbiológiai módszerek alkalmazása növénynemesítésben. (**The application of radiobiological methods to plant breeding).**
Növénytermelés 1960 : **9** : 181–90.

In this review, the topics discussed include: (1) the theoretical basis of the use of radiobiological methods, reference being made to the target theory and to the possibilities of directed mutagenesis; (2) some methods and results of mutation breeding; (3) the use of radiobiological methods in pollination studies and in physiology; and (4) the stimulation of yield by small doses of radiation.

1258 Matsumura, S. & Fujii, T.
Radiosensitivity in plants, II. Irradiation experiments with vegetatively propagated plants.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 22–32.

Sensitivity to damage by X and γ rays was studied in camphor, lemon, strawberry, sweet potato, tulip, gladiolus, carnation and chrysanthemum. Differences in sensitivity were noted not only between species but between varieties within species. [Cf. XXIX, 3502].

1259 Craig, I. L. & Murray, B. E.
X-irradiation. What can it possibly mean to the farmer?
Res. Fmrs., Ottawa 1960 : **5** : No. **4** : 3–4.

With reference to investigations at the Genetics and Plant Breeding Research Institute, Ottawa, the possibility of inducing economically valuable mutants in crops by X rays is discussed. Mention of potentially useful mutants of tomato and pea produced at the institute by this means is included. The effects of X-ray exposure upon lucerne have been studied extensively to elucidate the impact of this treatment upon a polyploid genetic system. Application of X-irradiated pollen to stigmas of vigorous male-sterile plants has been found to be the most effective technique for inducing variation in this crop.

1260 Rédei, G.
Genetic control of 2,5-dimethyl-4-aminopyrimidine requirement in *Arabidopsis thaliana.*
Genetics 1960 : **45** : p. 1007. (Abst.).

A recessive heritable change, induced by X rays, resulted in seedling lethality, unless 2,5-dimethyl-4-aminopyrimidine (Py) was supplied. Thiamin, phosphoric esters of thiamin, acetylthiamin and neopyrithiamin also satisfied the nutritional requirement. With an appropriate amount of Py, recovery of the mutant was complete; fertility was normal. The pattern of inheritance of the mutant has been somewhat anomalous.

1261 Kada, T., Doudney, C. O. & Haas, F. L.
Some biochemical factors in X-ray-induced mutation in bacteria.
Genetics 1960 : **45** : p. 995. (Abst.).

Several lines of evidence have indicated that DNA synthesis is the terminal event in ultraviolet-induced mutation but for phenotypic expression protein synthesis subsequent to DNA synthesis is required. About half of the X-ray induced reversions of a tryptophane-requiring auxotroph of *Escherichia coli* to the wild type were lost through incubation for 1 hr. with chloramphenicol or 6-azauracil, after irradiation agents which block RNA or protein synthesis. However, in contrast to ultraviolet-induced reversion, it appeared that chloramphenicol or 6-azauracil was necessary for subsequent sensitivity of the mutations to the action of either chemical agent. These mutations require RNA and protein synthesis and probably DNA synthesis for induction, in a manner comparable to ultraviolet-induced reversion. The remainder of the X-ray induced reversions were not lost as the result of posttreatment with chloramphenicol or 6-azauracil for 1 hr. prior to plating on a tryptophane-containing medium. These mutations were completely expressed when plated on a minimal medium and before measurable DNA synthesis occurred. They were not expressed, however, in the presence of 6-azauracil or chloramphenicol. The data suggest that in the second group the functional reversion was induced by X irradiation without the necessity of DNA replication but that RNA and protein synthesis was required for phenotypic expression of the reverted character.

Proceedings of the Second UN International Conference on the Peaceful uses of Atomic Energy. Vol. 22. Biological effects of radiation,
Geneva 1958 : Pp. ix + 552.

Some of the papers in this volume have already been abstracted from another source [cf. XXIX, 4690–91, 4693–94 and 4696–97]; the remaining papers of interest to plant breeders and geneticists are summarized below.

1262 *Neary, G. J. & Evans, H. J. Gamma radiation-induced mitotic delay and chromosome breakage. (pp. 303–07).*

Use of the method described earlier [XXVII, 3716] showed that mitotic delay was dose dependent and was greatest in cells treated at an early stage of interphase. Work on the effect of oxygen upon γ-radiation-induced mitotic delay has already been reported [cf. XXIX, 3471], as have also studies of γ-ray-induced chromosome breakage [XXIX, 1257].

1263 *Bora, K. C. Relative biological efficiencies of 220 kvp X rays and* 14·1 *Mev fast neutrons in the induction of aberrations in chromosomes of* Tradescantia *at low temperature. (pp. 342–50).*

The relative biological efficiency (RBE), that is, the ratio of the number of aberrations induced by fast neutrons to that induced by X rays, was studied in microspores of *T. paludosa* at temperatures of 22 ± 1° C. and 2·5 ± 0·5° C., over the dose range 100–600 rads. For inducing chromosome reunions, large chromosome deletions, minute chromosome deletions and microspore damage, the RBE increased at the low temperature by factors of 1·31, 1·40, 1·37 and 1·34 respectively. The RBE also varied according to type of aberration and to dose, all RBE values showing an increase with dose up to a peak, which varied for temperature and type of aberration but always occurred in the range 100–350 rads, and then a decrease to unity.

1264 *Withrow, R. B. & Moh, C. C. Non-ionizing radiant energy as a mediating factor controlling radiation damage in plants and animals. (pp. 400–03).*

Observations on the potentiating effect of far-red radiant energy on the frequency of X-ray induced chromosome aberrations, and the nullifying effect of red, have already been reported [cf. XXVII, 3723, XXIX, 2258 and XXX, 1094]. In the present paper it is further noted that when far-red energy is supplemented by blue energy (436 $m\mu$) at 4000 μw/cm.^{2} the effects are similar to those of far red alone.

1265 *Tobias, C. A., Mortimer, R. K., Gunther, R. L. & Welch, G. P. The action of penetrating radiations on yeast cells. (pp. 420–26).*

The following points from work carried out at Berkeley, Calif., are mentioned. X-ray sensitivity in terms of survival is lowest in haploids, highest in diploids and then decreases with increasing genome number. Induced recessive and dominant lethals can account for most of the inhibition of cell division by X rays at various levels of ploidy. As a result of genetic rearrangement, including mitotic crossing over, the progenies of X-irradiated cells vary much in division time and in production of inviable cells. The rate of X-ray induced reverse mutation and its dependence upon oxygen vary greatly from strain to strain. Steady-state populations can exist under continuous irradiation, the cell division rate falling off linearly with increasing dose per generation until it levels off at about 2500 r.

1266 *Magni, G. E. Changes of radiosensitivity during meiosis in* Saccharomyces cerevisiae. *(pp. 427–31).*

Percentage survival of vegetative diploid strains showed a sigmoidal decrease with increasing X-ray dose. For most strains a sigmoidal survival curve was also obtained in cells treated at various intervals after transfer to a sporulation medium, the cells equalling the vegetative cells in resistance until about 12 hr. after transference, reaching their highest resistance at about 16 hr. and decreasing again at about 24 hr. when the second division was almost completed. In one strain, however, although similar quantitative changes were observed during sporulation, the survival curves during meiosis were exponential. The results of crosses indicated that the exponential type of inactivation was conditioned by an incompletely dominant gene, *Rs*.

1267 OEHLER, E.
Radioaktivität im Dienste der Mutationsforschung und Pflanzenzüchtung. **(Radioactivity in the service of mutation research and plant breeding).**
Schweiz. landw. Mh. 1960 : 38 : 261–75.

This survey covers briefly the history, techniques and results of mutation induction by irradiation.

1268 MYERS, W. M.
Some limitations of radiation genetics and plant breeding.
Indian J. Genet. 1960 : **20** : 89–92.

The limitations and potentialities of mutation breeding are discussed. The need to utilize more fully the natural variability within a species or genus before devoting limited resources to the artificial induction of increased variability is emphasized.

1269 DOUDNEY, C. O. & HAAS, F. L.
Some biochemical aspects of the postirradiation modification of ultraviolet-induced mutation frequency in bacteria.
Genetics 1960 : **45** : 1481–502.

Postirradiation treatments blocking RNA or protein synthesis markedly lowered the ultraviolet-induced mutation frequency (reversion of tryptophane requirement) in *Escherichia coli* 'WP2.' Treatments of less than 20 min. duration reduced the mutation frequency to a minimum level without significant modification of the time or rate of subsequent synthesis of RNA, DNA and protein. This suggests that the mutation-frequency decline is an active process, probably enzymatically mediated, and not dependent on delay in postirradiation macromolecular synthesis. The progressive loss of susceptibility of the potential mutation to these treatments is closely correlated with the progress of RNA synthesis in the culture. A relation exists between the amount of RNA synthesized at the time of chloramphenicol addition, the relative rate of DNA synthesis in the presence of chloramphenicol, and the induced-mutation frequency. It appears that DNA may be formed only when the RNA and protein necessary for genetic replication are synthesized prior to chloramphenicol addition. When the RNA and protein involved have not been formed, the potentiality for mutation is lost through the active-decline process.

Decline in induced-mutation frequency is promoted by 5-hydroxyuridine after a considerable lag. This decline is correlated with the doubling of RNA in the culture, suggesting that the analogue causes the decline through incorporation into the RNA. However, loss of susceptibility to the 5-hydroxyuridine-promoted reduction in mutation frequency occurs prior to measurable RNA synthesis and is correlated with the mutation stabilization process. Incubation with 5-hydroxyuridine for sufficient time to prevent all sensitive mutations does not delay DNA synthesis. Several lines of evidence indicated that DNA synthesis is the terminal event in ultraviolet (UV)-induced mutation. However, delay of DNA synthesis does not modify UV-induced mutation frequency in the absence of the active-decline process unless drastic treatments which grossly alter cellular metabolism are employed. Loss of mutation photoreversibility is correlated with DNA synthesis in the culture. Dinitrophenol, but not chloramphenicol, blocks the loss of mutation photoreversibility.

1270 PHILLIPS, J. N. (JUN.)
Modification of mutation frequency in microorganisms through use of multiple mutagen treatment.
Genetics 1960 : **45** : p. 1005. (Abst.).

Recent work on *Escherichia coli* has led to the general hypothesis that the time of establishment of an induced mutational event is prior to synthesis of the affected self-replicating genetic material. To test the applicability of this hypothesis to other microorganisms (algae and Actinomycetes), three different types of mutagen were used separately, in pairs or all together in a single procedure. The mutagens were (1) ultraviolet radiation, (2) RNA and DNA analogues and (3) alkylating agents. In some populations, large increases in mutation frequency were attained provided the single, double or triple treatment was appropriately integrated with cell-division events. The mutagens were approximately additive in action when used in pairs but appeared to act synergistically when all three types were applied in a single procedure.

1271 RÖHRBORN, G.
Chemische Konstitution und mutagene Wirkung. Klassifizierungsversuch chemischer Mutagene. (**Chemical constitution and mutagenic action. An attempt to classify chemical mutagens**).
Experientia 1960 : **16** : 523–29.

Chemical mutagens are classified and surveyed under the headings alkylating agents, basic dyes, peroxides, antimetabolites, and other chemicals. The possible modes of action involved within each group are discussed.

1272 RAPOPORT, I. A.
(**The interaction of gene proteins with 1,2-dichlorethane**).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **134** : 1215–17. [Russian].

Data on the frequency of sex-linked mutations in *Drosophila* from treatments with the above mutagen are presented. The mutations are attributed to chemical interaction of the mutagen with the gene proteins. One characteristic of the mutagen, which distinguishes it from other mutagenic agents, is that it induces a greater number of mutations in immature than in mature sperm cells. Numerous heritable changes were induced however in mature female sex cells.

1273 RAPOPORT, I. A.
(Mutagenic effect of di-β,β^1-chlorethyl phosphite).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **134** : 1447–49. [Russian].

A high percentage of mutations was observed in *Drosophila* whose eggs and larvae were reared on a nutrient substrate containing the above mutagen.

1274 PROZOROV, A. A.
(The effect of some radiation-protective substances on the mutation rate of an unstable strain of *Bacterium prodigiosum*).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 679–82. [Russian].

The rate of mutation in the above strain was reduced by sodium hydrosulphite and thiourea and increased by potassium permanganate, but was not altered by unithiol and cysteine.

1275 BARNETT, W. E. & DEBUSK, A. G.
Nitrous acid induced reverse mutation in *Neurospora crassa.*
Genetics 1960 : **45** : 973–74. (Abst.).

The authors investigated induction of reverse mutation in auxotrophic strains. In particular, an ultraviolet-induced adenine-requiring strain has been used. "The kinetics of the reverse mutation process indicate the physical dimensions of the mutated region. Thus far, testcrosses with revertant types have not demonstrated the presence of suppressor mutations. These preliminary results indicate that the nitrous acid reverse mutation process may furnish a useful tool for the determination of the dimensions in nucleotides of many point mutations."

1276 TESSMAN, I.
Mutagenesis in phages ϕ X174 and T4 and properties of the genetic material.
Virology 1959 : **9** : 375–85.

Mutants of ΦX174 and T4 were produced by *in vitro* treatment with nitrous acid; those of ΦX174 arose in pure clones and the T4 mutants in mixed clones. This indicates that ΦX174 contains only one copy of the genetic information whilst T4 contains at least two. These results are also consistent with the view that the DNA of T4 is present in the Watson-Crick double-stranded configuration and that of ΦX174 is single-stranded. The production of mutants in ΦX174 was a one-hit process indicating that the deamination of a single base is sufficient to produce a host-range mutant.

1277 VIELMETTER, W. & SCHUSTER, H.
Die Basenspezifizität bei der Induktion von Mutationen durch salpetrige Säure im Phagen T2. **(Base specificity in the induction of mutations by nitrous acid in phage T2).**
Z. Naturf. 1960 : **15b** : 304–11.

In phage T2 treated with HNO_2, the deamination rates of the amino bases guanine (G), adenine (A) and 5-hydroxymethylcytosine (HMC) of the DNA can be shifted relative to each other by altering the pH of the treatment. A comparison of the rates of induction and inactivation of r^- mutants by HNO_2 at different pH values with the corresponding alterations in deamination rates showed that deamination of A and HMC can lead to mutagenic changes, while the deamination of G can only act lethally. It was estimated that, in the rII region of the genome, deamination of any one of 370 base pairs (about $\frac{1}{2}$–$\frac{1}{3}$ of all the nucleotides in this region) can lead to the induction of a mutation. Further, deaminations in about $\frac{1}{4}$ of the total DNA may be lethal.

1278 SHANKEL, D. M.
Studies on mutations induced by noncidal ultraviolet light.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1999 : p. 4491. (Abst.).

The results obtained from a study of mutation induced in *Escherichea coli* by exposure to ultraviolet (UV) rays without a detectable amount of concomitant killing have led to the following hypothesis concerning the induction and development of mutants arising through such treatment. "The UV light causes changes in the substance of the genetic material *in situ* and also some generalized intracellular damage resulting in modification of precursor materials and a physiological lag period. The mutants which result from the direct damage are not influenced by post-irradiation nutrition (except as required for growth), are not photoreversible, and are independent of the effect of chloramphenicol on protein synthesis. The modified intracellular precursors are also able to produce mutants by being incorporated into RNA (which subsequently acts as the template for formation of new genetic material) during the physiological lag period before active cellular synthesis is resumed. The mutants which may be produced in this manner are only expressed if provided with suitable complex nutrients, are subject to photoreversal prior to their incorporation, and do not express if protein synthesis is inhibited by chloramphenicol."

1279 MARQUARDT, H. & ZIMMERMANN, F.
Die relative genetische Wirksamkeit der harten und weichen Röntgenstrahlen sowie der 25 MeV-Elektronen im Rückmutationstest bei *Neurospora.* **(The relative genetic efficiency of hard and soft X rays and also of 25 MeV. electrons in the back-mutation test with *Neurospora*).**
Naturwissenschaften 1960 : **47** : p. 235.

The number of back mutations from adenine dependence induced by 185 kV. rays was proportional to dose in the range 10–100 kr.; for 65 kV. rays, mutation frequency was only proportional to dose up to 25 kr. and then decreased. The 25 MeV. electrons produced a significantly lower mutation rate than the X rays at 10 kr. but at higher doses the difference disappeared.

1280 MITOV, G.
(Variability in *dysenterica* and *coli* bacteria induced through vegetative hybridization).
Izv. mikrobiol. Inst., Sofija 1960 : **11** : 275–92. [Bulgarian].

The antigenic and biochemical characteristics and the virulence of bacterial strains could be changed by vegetative hybridization with mentors consisting of killed bacterial cells of different strains. The degree of change varied according to strain, but changes from one species to another were not effected.

1281 FILIPPOS'JAN, S. T.
(Hereditary variability of some microorganisms under the action of antibiotics).
Ž. obšč. Biol. (J. gen. Biol.), Moskva 1959 : **22** : 481–83. [Russian].

By culturing *Salmonella* and *Klebsiella* strains sensitive to tetracyclin and colimycin on media with gradually increased amounts of these antibiotics, resistant strains with altered morphological, cultural, biochemical and serological properties were obtained. The resistance acquired by the strains was lost by them gradually after culture on media containing no antibiotic.

1282 FOLTÝN, J.
Šedesátiny akademika T. D. Lysenka. **(On the sixtieth birthday of Academician T. D. Lysenko).**
Za socialist. Zeměd. 1958 : **8** : 863–64.

Lysenkoist genetics and its applications in Czechoslovakia are briefly considered.

1283 LYSENKO, T. D.
(The question of interrelations between biology and chemistry and physics).
Agrobiologija (Agrobiology) 1959 : No. 4 : 484–88. [Russian].

The contentions by some Soviet critics of Mičurinism that biochemistry and biophysics should be applied to biological research, including genetics, and that advances made in biology in the USSR lag behind those in other countries are rebutted. In particular "idealist" studies seeking the discovery of the hereditary substance are condemned and the Mičurinist view that the whole organism undergoes heritable changes through the influence of the environment is repeated. Semenov is criticized for doubting whether winter wheat can be trained for the spring habit and *vice versa.*

1284 PREZENT, I. I.
(Is biology a temporal science).
Agrobiologija (Agrobiology) 1959 : No. 4 : 489–97. [Russian].

Mičurinist and philosophical reasons are given why biology should be considered as independent of chemistry and physics [cf. 1283]. In a section dealing with genetics, the author discusses the fallacies of Morgano-Mendelism, among which are included "symbolized factors", the gene and heritable substance and the rejection of the Mičurinist principles of selective fertilization and the inheritance of acquired characters.

Biochemical and biophysical research has a place in the promotion of biological studies. For instance, recent studies of nucleic acids are said to confirm Mičurinist views on vegetative hybridization and to show that several substances, besides DNA, are responsible for heritable transformation and that therefore there is no substance which alone determines heredity.

1285 Fejginson, N. I.
(Lamarck, Darwin, Haeckel and the present position of the problem of the inheritance of acquired characters).
Agrobiologija (Agrobiology) 1959 : No. 5 : 723–32. [Russian].

In this historical survey it is concluded that Lamarck, Darwin, Haeckel, Daniel and Timirjazev accepted the inheritance of acquired characters as an established fact, as do the supporters of Mičurinism. Some of the western geneticists are said to agree with them, but reluctantly and with certain reservations.

1286 Glushchenko, I. [Gluščenko, I. E.]
Can heredity be controlled ?
Allahabad Fmr. 1960 : **34** : 100–04.

Lysenko's views on heredity as presented in the recently published selected works of T. D. Lysenko are outlined and their correctness affirmed.

1287 Rokickij, P. F.
(A study of the process of artificial selection under conditions of natural variation and of variation induced by X irradiation).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1959 : **64** : No. 4 : 75–97. [Russian].

Figures are presented showing that selection in *Drosophila* over 25–40 generations was effective in some lines and not in others. Sudden increases in effectiveness after a number of generations of ineffective selection are ascribed to mutation. In some lines selected in a particular direction, mutations in the opposite direction occurred. Mutation in one gene was often followed by a period of greatly increased variation, which is explained by recombinations of the new gene with a number of other genes originally present but not manifested. This is regarded as an example of the creative role of selection. The process was accelerated by irradiation.

EVOLUTION

1288 Poljanskij, V. I.
(On the integrity of the species and its evolution).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1959 : **64** : No. 4 : 5–13. [Russian].

A species is seen as an aggregate of forms which, though differing between themselves in many features, constitute an integral group. This integrity is considered more fundamental than any possible hiatus between species. It is generally expressed in the possession of a number of adaptive features in common. Integrity, based on common history, may exist even in components of a species having discrete areas. It has become clear that existing species differ in kind, extreme cases being sexual and agamic species, each regarded as equally valid in their own way. Various types of congruence are exemplified, where advantage to the species may accrue from the sacrifice of certain individuals or groups. Intraspecific competition is regarded as an essential part of specific integrity.

1289 Fischer, H. E.
Schopenhauer und die Abstammungslehre. **(Schopenhauer and evolutionary theory).**
Forsch. Fortschr. dtsch. Wiss. 1960 : **34** : 321–26.

In this article, written in honour of the centenary of Schopenhauer's death, the author reviews some of Schopenhauer's (pre-Darwinian) ideas on evolution and criticizes them in the light of current views on evolution and genetics.

1290 Whyte, L. L.
Developmental selection of mutations.
Science 1960 : **132** : p. 954.

Discussing the above topic in a general manner, the writer expresses the following view. "The direction of evolution may at times be determined by the internal selection of genotypes during development, rather than by the external selection of phenotypes. Biological theory and experiment have reached the point where those concerned with evolutionary problems or with nuclear and cellular organization should consider this possibility."

1291 Pantin, C. F. A.
Alfred Russel Wallace: his pre-Darwinian essay of 1855.
Proc. Linn. Soc. Lond. 1960 : **171** : 139–53.

A note on background facts to Wallace's writing of this essay published in the *Annals and Magazine of Natural History* for 1855 and on its contribution to evolutionary theory is followed by a reprint of the essay.

1292 Piza, S. de T. (Jun.)
Evolução, do Padre Roldán, S. J. **(Evolution according to Padre Roldán, S. J.).**
Rev. Agric., Piracicaba 1959 : **34** : 1–10.

An elaborate critique is presented of the evolutionary theory of A. Roldán which accepts evolution at the microevolutionary level but involves creationist ideas at the macroevolutionary level.

1293 Whitehouse, H. L. K.
Origin of angiosperms.
Nature, Lond. 1960 : **188** : p. 957.

Referring to his hypothesis that the angiosperms may owe their origin to the evolution of multiple-allelic self incompatibility [cf. XX, 1364], the author expresses the view that they may have arisen so rapidly that there is little likelihood of the preservation of early angiosperms as fossils. It is suggested that the best hope of finding recognizable ancestors of the angiosperms lies in a study of fossil gymnosperms in the Middle Cretaceous.

1294 Rîjkov [Ryžkov], V. L.
Diferenţierea citoplasmei in procesul de formare a speciilor. (**The differentiation of the cytoplasm in the process of species formation**).
An. Romîno-Soviet. : Ser. Biol. 1959 : **13** : No. 3 : 33–40.

[Cf. XXX, 1063].

1295 Dobzhansky, T.
Individuality, gene recombination, and non-repeatability of evolution.
Aust. J. Sci. 1960 : **23** : 71–74.

The substance is given of the Goldworthy Lecture, read before the Society for Experimental Biology of New South Wales, in Sydney, 29 March 1960. The subjects are discussed mainly with reference to the population genetics of *Drosophila* and to man.

1296 Lysenko, T. D.
(**Darwinism lives and progresses**).
Agrobiologija (Agrobiology) 1959 : No. 5 : 647–64. [Russian].

This is the first article in the above number of the periodical which is wholly dedicated to Darwin, Lamarck and Haeckel. It recapitulates the basic principles of Mičurinism, including Lysenko's theories on evolution by interspecific conversions.

1297 Alekseev, V. A.
(**Charles Darwin and the centenary jubilee of Darwinism**).
Agrobiologija (Agrobiology) 1959 : No. 5 : 674–93. [Russian].

A treatise on Darwinism, which is identified with Mičurinism, and its rival theories is presented. Some prominent Soviet and western geneticists and evolutionists are criticized for their Weismannist and neo-Darwinist fallacies.

1298 Poljakov, I. M.
(**The laws of Lamarck**).
Agrobiologija (Agrobiology) 1959 : No. 5 : 694–706. [Russian].

Lamarck's ideas on evolution are discussed from a Mičurinist viewpoint.

1299 Prezent, I. I.
(**A militant biologist-materialist, Ernst Haeckel**).
Agrobiologija (Agrobiology) 1959 : No. 5 : 707–16. [Russian].

Schneider, G.
(**An eminent German Darwinist**).
Ibid. 1959 : No. 5 : 717–21. [Russian].

Laudatory accounts of Haeckel, together with an outline of his evolutionary concepts, are presented.

1300 Golubev, V. N.
(**On the morphogenesis of woody plants and the trends of morphological evolution from trees to grasses**).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1959 : **64** : No. 5 : 49–60. [Russian].

Examination of the morphology of a number of bushy species in the juvenile stages has revealed similarities of structure between those that have a rosette-like growth when mature and those that do not and similarities with corresponding types among herbaceous species. Certain species, such as *Sambucus racemosa*, behave as herbaceous types in the first few years and only later behave as bushes. *Rubus idaeus* is cited as another intermediate type. It is concluded that the herbaceous species have evolved from tree species by a fixation of the juvenile forms.

1301 Sukačev, V. N.
(**New data on the experimental investigation of plant interrelation**).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1959 : **64** : No. 4 : 35–46. [Russian].

Cuttings of *Salix viminalis* and *S. purpurea* were planted separately and together, at different spacings. At the end of the growing season the mean length of the withes was greater in dense spacing (9 x 9 cm.) than in wide spacing (18 x 18 cm.) in both species. No competition was observed in the mixed plantings at the wide spacing but in the dense spacing *S. purpurea* showed a reduction in withe length whereas *S. viminalis* did not. Darwin's assumption that intraspecific competition is greater than interspecific is thus not supported.

When a single individual of *S. purpurea* was grown surrounded by *S. viminalis* its growth was retarded whereas an individual of *S. viminalis* surrounded by *S. purpurea* was not affected.

Five biotypes of *S. purpurea* differing in certain morphological and other features were planted at spacings of 50 x 50 and 8 x 8 cm., in pure stands and in pairs. The biotypes differed in the degree to which their growth was reduced in close planting; however, the biotypes that suffered most in pure stands were not those that suffered most when planted with other biotypes. Certain combinations of biotypes gave higher yields than the pure stands, some lower; in some combinations one partner suffered more and the other less from competition than in the pure stands.

When a mutant of *Arctium tomentosum* without pappus was sown together with the normal form, the mutant proved more successful in competition and began to spread naturally in a park in Leningrad.

1302 Wilson, A. T.

Synthesis of macromolecules under possible primeval earth conditions.

Nature, Lond. 1960 : **188** : 1007–09.

By passing an electric discharge through a mixture of 10 g. ashed yeast dissolved in 100 c.c. water, NH_3, H_2S and CH_4, sheets of a solid high polymer of the polyethylene type were obtained. It is suggested that some such process in the putative reducing atmosphere of the primeval earth resulted in "hydrocarbon life" which could then have developed till sufficiently complex to synthesize the proteins necessary for contemporary "protein life".

CYTOLOGY

1303 Whaley, W. G., Mollenhauer, H. H. & Leech, J. H.

Some observations on the nuclear envelope.

J. biophys. biochem. Cyt. 1960 : **8** : 233–45.

Root-meristem cells of maize were fixed in $KMnO_4$, embedded in epoxy resin, sectioned and examined with the electron microscope. The nuclear envelope consisted of two membranes, each being about 80 Å. thick. It was possible to detect pores of the type reported for many species of plants and animals, different types of openings associated with extension of both nuclear membranes into the cytoplasm, and large discontinuities. The nuclear envelope is thus a component of the general vesicular reticulum.

1304 Wilkinson, J.

Virus-induced abnormalities of mitosis in certain Solanaceous species.

Ann. Bot., Lond. 1960 : **24** : 516–21.

Mitotic irregularities were studied in species of *Nicotiana*, *Solanum*, *Hyoscyamus*, *Physalis*, *Lycopersicon* and *Petunia* infected with tobacco mosaic or aspermy virus. The abnormalities ranged from persistence of the nucleolar material until early anaphase in all the species examined to complete amitosis in stem enations of *Petunia violacea*. These observations are regarded as providing support for the view that virus particles, multiplying within dividing cells, compete with the nuclear DNA for the RNA supply in the nucleolus.

1305 Skalińska, M. *et al.*

Further studies in chromosome numbers of Polish Angiosperms (Dicotyledons).

Acta Soc. Bot. Polon. 1959 : **28** : 487–529.

Somatic chromosome numbers are given for 96 species pertaining to 26 families. Among the 16 species for which numbers have not previously been reported are: *Betula oycoviensis*, $2n = 28$; *B. carpatica*, $2n = 56$; *Artemisia austriaca*, $2n = 16$; *A. absinthium* var. *calcigena* and *A. abrotanum*, $2n = 18$; and *A. petrosa*, $2n = 18$ and 36. Numbers differing from those previously reported have been found in nine species.

1306 Lighty, R. W. & Plaisted, R. L.

The evaluation of the sources of variation in the preparation of a karyotype of a clone.

Cytologia, Tokyo 1960 : **25** : 1–7.

From an analysis of arm ratios of chromosomes of *Lilium candidum*, it was concluded that intraclonal variation in arm-ratio measurements of homologues is mainly attributable to the effects of the cytological manipulation rather than to variations in the living material. The variance tended to increase as the mean arm ratio increased. The bearing of this finding on the general procedure of caryotype determination is considered.

1307 Sharma, A. K. & Bhattacharyya, N. K.

An investigation on the scope of a number of pre-treatment chemicals for chromosome studies in different groups of plants.

Japan. J. Bot. 1960 : **17** : 152–62.

The effectiveness of esculin, paradichlorobenzene, coumarin, oxyquinoline, phloroglucinol, colchicine and chloral hydrate in clarifying chromosome structure was studied in a number of species with chromosomes of various sizes and numbers and belonging to the Amaryllidaceae and the Umbelliferae. Irrespective of the type of chromosome complement, the best results were obtained with esculin in the case of Amaryllidaceous species and with paradichlorobenzene in Umbelliferous species. The finding that species in the same family behave in a similar way, despite minor differences in concentration, temperature and length of treatment required, is discussed with special reference to the need to avoid testing chemicals on a chance basis.

1308 Korec, M. A.
(How the cell starts dividing).
Priroda (Nature), Leningrad 1960 : No. 10 : p. 91. [Russian].

The physics of chromosome division is discussed.

1309 Wimber, D. E.
Duration of the nuclear cycle in *Tradescantia paludosa* root tips as measured with H^3-thymidine.
Amer. J. Bot. 1960 : **47** : 828–34.

The average time required for a complete mitotic cycle was estimated as 20·0 hr., the duration of the different phases being as follows: DNA synthesis during interphase, 10·8 hr.; presynthetic interphase, 4 hr.; post-synthetic interphase, 2·7 hr.; prophase, 1·6 hr.; metaphase, 0·3 hr.; and anaphase-telophase, 0·6 hr.

1310 Flaten, C. M.
Cine-micrographic studies of mitosis in Tradescantia staminal hair cells (treated and untreated).
Diss. Abstr. 1960 : **20** : LC Card Mic 60–820 : 4254–55. (Abst.).

Observations on untreated cells and on cells treated with colchicine or gammexane are reported.

1311 Hyde, B. B.
Cytochemical determination of the proportion of protein-bound S–S to –SH in chromatin at three different stages of mitosis.
Genetics 1960 : **45** : p. 993. (Abst.).

The Barrnett-Seligman procedure was applied to determine the ratio of protein-bound S–S to SH groups in chromatin at different stages of mitosis in onion root tips; thioglycolic acid (TGA) was used as reducing agent. Resting chromatin had a somewhat higher proportion of S–S to SH than metaphase chromosomes. Telophase chromatin, however, appeared to have no S–S groups. Nucleolar protein had a proportion of S–S to SH groups slightly less than that for metaphase chromatin. The results provide no support for the view that oxidation of SH to S–S groups is involved in chromatin condensation during prophase. It is nevertheless suggested that the apparent decrease in the S–S : SH ratio from resting stage to metaphase may be caused by a greater resistance of S–S groups in metaphase chromatin to reduction by TGA. Telophase determinations were in conformity with this hypothesis. Complete reduction of S–S to SH groups apparently accompanied uncoiling at telophase.

1312 Davidson, D.
Polyamines and chromosome condensation.
Genetics 1960 : **45** : 983–84. (Abst.).

The effect of the diamines putrescine and cadaverine and the tetramine spermine upon mitosis in plant roots was investigated. All stages may be affected within a 6-hr. period of treatment with 0·5 mM solutions. At metaphase the chromosomes condensed and stained heavily with Feulgen, a single amorphous structure being formed. At anaphase-telophase chromosome uncoiling was prevented, the nucleus becoming palmate. Longer treatments suppressed all mitotic activity. These naturally occurring polyamines may be involved in the processes of spiralization.

1313 Harte, C. & Zinecker-Brauer, I.
Über das Mitoseverhalten in den Wurzelspitzen von *Vicia faba*. II. Analyse der Variabilität der Mitosehäufigkeit.
(On mitotic behaviour in root tips of *V. faba*. II. Analysis of the variability of the frequency of mitosis).
Chromosoma 1960 : **11** : 463–78.

Continuing previous studies [cf. XXIII, 866], it was found that the frequency of mitosis reaches a maximum at midday and a minimum during the night. Day-to-day variation was observed in the frequency distributions and in the average frequency.

1314 D'Amato, F.
Cyto-histological investigations of antimitotic substances and their effects on patterns of differentiation.
Caryologia 1960 : **13** : 339–51.

The text is given of a contribution to the Ninth International Botanical Congress [cf. XXX, 3549].

1315 Olszewska, M. J.
Obserwacje przyżyciowe nad wpływem kinetyny na czas trwania niektórych stadiów mitozy. (***In vivo* observations on the influence of kinetin on the duration of certain stages of mitosis**).
Acta Soc. Bot. Polon. 1959 : **28** : 471–76.

Treatment of staminal hairs of *Tradescantia virginiana* with a 10^{-6} % solution of kinetin resulted in a slowing down of metacinesis and metaphase, a decrease in the duration of anaphase and a marked decrease in the rapidity of cell plate formation.

1316 Rollen, A.
Action de l'alcool amylique tertiaire (hydrate d'amylène) sur la division cellulaire chez l'*Allium sativum* L. [**The action of tertiary amyl alcohol (amylene hydrate) on cell division in *A. sativum* L.**].
Bull. Soc. bot. Fr. 1960 : **107** : 175–84.

Weak solutions were found to have a mitodepressive and mitostatic action on the nuclei of root-tip cells of *A. sativum*; higher concentrations were lethal. The effect is compared with that of isoamyl alcohol and octanol [cf. XXVIII 2316].

1317 Pazourek, J.
Testung verschiedener Faktoren mit Hilfe der Mitosenanzahl. (**Testing different factors with the aid of the mitotic number**).
Flora, Jena 1960 : **149** : 477–86.

A method for determining the number of mitoses in root tip meristems under different conditions is described. Using a microscope with a mechanical stage, counts are made at points uniformly distributed over the preparation. The required number of counts per preparation and required number of roots are determined by statistical procedures.

1318 Satô, S.
Electron microscope studies on the mitotic figure. III. Process of the spindle formation.
Cytologia, Tokyo 1960 : **25** : 119–31.

Electron-microscopic investigation of spindle development during meiosis I in *Lilium* revealed the following. As prophase proceeded numerous granules appeared, at first localized near the nuclear membrane. They assembled on the surface of the chromosomes and became distributed uniformly in the nuclear cavity. Upon completion of diacinesis, short fine fibrils appeared where the granules had previously been observed. The fibrils at first had no orientation but later were parallel to the spindle axis. These fibrils became the unit fibrils of the metaphase spindle. The chromosomal fibre developed towards the pole from an aggregation of granules at the centromere and, as it developed, bound the unit fibrils. [Cf. XXX, 2266].

1319 Riley, H. P. & Hoff, V. J.
Chromosome breakage in *Tulbaghia violacea* by radiation and chemicals.
Nucleus, Calcutta 1960 : **3** : 1–18.

Breakage was investigated in *T. violacea* because this species has a prominent secondary constriction in one chromosome. Root tips treated with X rays (126·5, 260 and 357·5 r.) or chemicals were examined for breaks (1) at the centromere, (2) at the secondary constriction or (3) in other parts of the SAT chromosome as determined by counting the acentric fragments. X-ray exposure caused considerable increase in frequency of (1) and (2). The frequency seemed to increase linearly with dose. The frequency of (3) also increased markedly, its relationship with dose being exponential. Most of the fragments resulted from two-hit aberrations. Treatment with the phenols pyrogallol, resorcinol and phloroglucinol in concentrations ranging from 0·0005 to 0·001 M generally resulted in a higher frequency of (2) and (3), and with the first two of these compounds, the number of (1) also increased. With the pyrogallol derivative gallic acid, however, the frequency of (2) decreased, while that of (3) underwent considerable increase after treatment with a 0·0001 M solution. Treatment with 0·1 M maleic hydrazide, 0·0002 M oxyquinoline and 0·0014 M coumarin brought about a moderate increase in the frequency of (3) but a decrease in number of (2). Less concentrated solutions resulted in a decrease in frequency of (2), but had no important effect on number of fragments. Cysteine hydrochloride (0·0005–0·0001 M) and sodium thiosulphate (0·01 M) caused a slight increase in breaks at the centromere but a decrease in the other two types.

1320 Matsumura, S. & Nezu, M.
(**The effects of X and γ irradiation on chromosome aberrations in the broad bean**).
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 98–101.

The effects of 600 r. of the above types of radiation on root-tip mitosis were investigated. The frequencies of bridges and fragments were ascertained and it is inferred that X rays produce 1·5 as many breaks as γ rays.

1321 KIRBY-SMITH, J. S., NICOLETTI, B. & GWYN, M. L.
The induction of chromosomal aberrations in Tradescantia pollen by combined X-ray and ultraviolet treatment.
Genetics 1960 : **45** : 996–97. (Abst.).

Using X-ray doses of 50 and 150 rads and ultraviolet (UV) exposures of 2650 and 2804 Å. in the range of 0·05 to 0·2 x 10^6 ergs/cm.^{2}, the modification of X-ray induced chromatid aberration by pretreatment and posttreatment with monochromatic UV radiation was investigated. Aberrations were examined in pollen-tube mitosis. A pronounced synergism in the action of the two agents was observed for both pretreatment and posttreatment with UV. The effect was slightly greater for UV pretreatment, but for both pretreatment and posttreatment at exposures of 0·2 x 10^6 ergs/cm.^{2}, aberration frequencies up to five times the sum of those found for X rays and UV when given alone were obtained. At the lowest UV exposure, the synergism was still twice strict additivity, although with this exposure no significant numbers of aberrations could be detected in pollen treated with UV alone. The magnitude of the synergistic effect appeared to be only slightly dependent on the time interval between the treatments within a period of up to 4 hr.

1322 PERSHAD, G. D.
Cytological aberrations of *Lilium* microsporocytes after gamma irradiation at pachytene and diakinesis.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1832 : p. 4494. (Abst.).

Among the observations were the following. "In material irradiated at pachytene a bridge at anaphase I was always associated with one fragment, and excess fragments were independent of bridges. In diakinesis irradiated material, bridges at anaphase I were of the 'two-sidearm' type, qualitatively different from the pachytene bridges, and were independent of fragments within cells. A hypothetical mechanism involving breakage and rejoining of chromatids at pachytene and of half-chromatids at diakinesis is proposed to account for the observed damage, taking into account the effect of possible non-sister cross-overs between the locus of the damage and the centromere. Some evidence for the existence of this mechanism is demonstrated.

"The frequency of both bridges and fragments bears a linear relationship to dose in the range of 19 to 57 rads in both pachytene and diakinesis irradiated materials in all varieties. Graphs of these curves strongly suggest a threshold effect at doses below 19 rads. It is proposed that each unit of observed damage is the result of two independent radiological events or 'hits'. The hypothesis is then advanced that the dose-damage relationship follows a curve of the 'squared exponential' type with its asymptotic portion accounting for the apparent threshold, and observed linearity is due to the fact that doses used fall into the essentially linear portion of such a curve.

"On the assumption of randomness of aberrations under study, their frequency distribution per cell should fit a Poisson distribution. In general, this was not observed. However, the data will fit perfectly if the assumption is made that only one-third of the damaged cells are observed. No satisfactory cytological explanation can be proposed for this striking observation except that for some reason two-thirds of the damaged cells may abort or slow down and never reach anaphase I.

"The lack of fit of radiation-induced interchromosomal aberrations to a Poisson distribution has been explained by other workers as being due to the existence of only a limited number of 'sites' where such exchanges are possible. It is shown that, even if such a limitation of vulnerability was applicable to these experiments, the damage should still follow a Poisson distribution."

1323 TAKEBE, H.
Effects of beta-ray irradiation on mitosis in *Tradescantia* with reference to dosage estimation.
Cytologia, Tokyo 1960 : **25** : 132–43.

Dosage of β rays from P^{32} was calculated in terms of r units, the equations being based on the number of ion pairs produced per disintegration. P^{32} treatment was about one-third or one-fourth as effective as high-intensity X rays in inducing chromosome aberrations in pollen and root-tip mitosis.

1324 WITTMER, G.
Attività citologica dell'olio estratto da semi vecchi e freschi di *Nicotiana rustica.* **(Cytological activity of oil extracted from old and fresh seeds of *N. rustica*).**
Tabacco, Roma 1960 : **64** : 172–93.

Further studies [cf. XXIX, 3482] made with different concentrations of oils extracted from *N. rustica* 'Erbasanta' applied to *Allium cepa* roots for varying lengths of time showed extracts from both old and young seeds to have the effect of mitotic poisons. Stickiness was produced more quickly by extracts from fresh seeds than from seeds 10 years old. In contrast to aqueous extracts, the oils also induced a certain number of c-mitoses. Chromosome fragmentation was more frequent after treatment with extracts from the older seeds.

1325 THOMAS, S.
Chromosome aberrations and mutations in nature.
Curr. Sci. 1960 : **29** : 376–79.

Divisional and chromosomal irregularities were induced in root tips of plants of *Chlorophytum heyneanum*, *Allium cepa*, *Trigonella foenum-graecum* and *Typhonium flagelliforme* grown in pots containing (1) sand + *Bassia* oil-cake or other kinds of oil-cake or (2) compost. Possibly nitrogen may be the active agent responsible for the aberrations resulting from either treatment. The bearing of these results upon the problem of the origin of natural mutations is considered.

1326 AHNSTRÖM, G. & NATARAJAN, A. T.
Chromosome breakage induced by electrolytically produced free radicals.
Nature, Lond. 1960 : **188** : 961–62.

Germinated seeds of barley were placed with their root tips on a platinum anode and electrolysed (4·5 V.) for 1 hr. in solutions of sodium acetate only and sodium acetate + (1) tyrosine, (2) cysteine or (3) tyrosine and cysteine. After treatment, the seeds were washed and allowed to recover for 18 hr. Material electrolysed in tyrosine exhibited at least a ten-fold increase in chromosome breakage over the remainder of the treatments. Addition of cysteine nullified the effect of tyrosine. The bearing of the results on the value of the reactivity of the genetic material towards chemical and physical agents is discussed.

1327 MICHAELIS, A. & RIEGER, R.
Einige Bemerkungen zur "mutagenen" Wirkung von Aluminiumchlorid bei *Vicia faba*. (**Some remarks on the mutagenic action of aluminium chloride in *V. faba***).
Mber. dtsch. Akad. Wiss. Berlin 1959 : **1** : 596–99.

No chromosome aberrations were induced in root tips by treatment with a series of $AlCl_3$ solutions of different strengths.

1328 LA CHANCE, L. E.
The influence of a CO_2 pretreatment on radiation induced chromosome aberrations in Tradescantia.
Genetics 1960 : **45** : p. 997. (Abst.).

Recent studies have indicated that cells irradiated in air + CO_2 show more chromosome exchanges and interstitial deletions than those treated in air alone; the effect of CO_2 appeared only when electromagnetic radiations were used and was completely lacking in the case of fission neutrons [cf. XXX, 1086]. Further experiments have been carried out to determine whether the presence of CO_2 actually at the time of irradiation is necessary for the enhancement of the aberration frequency. Inflorescences were pretreated for 1 hr. in air + an equal amount of CO_2 and then irradiated in air alone. The intervals between end of pretreatment and start of irradiation were 1, 5, 10, 15, 20, 40 and 60 min. The effect of air + CO_2 persisted after the termination of the pretreatment, decreasing linearly during the first 10 min. after termination of the pretreatment, reaching a plateau from 10 to 20 min. and then dropping to control levels in 40 min. These results are consistent with the hypothesis that, as a consequence of the decrease it causes in the viscosity of the protoplasm, CO_2 treatment promotes the movement of breakage ends and favours new reunions over restitution.

1329 FROST, S.
A new mechanism for numerical increase of accessory chromosomes in *Crepis pannonica*.
Hereditas, Lund 1960 : **46** : 497–503.

Root-tip cells of *C. pannonica* had only a single accessory chromosome while PMCs had two such chromosomes. The data obtained from crossing experiments demonstrated that an effective mechanism for increasing the number of accessories exists and is capable of inducing almost a doubling of the mean number of accessories from one generation to the next.

1330 O'MARA, J. G.
The probabilities of complete samples of simple aneuploids.
Genetics 1960 : **45** : p. 1004. (Abst.).

"The numbers of ways that a sample of simple aneuploids, monosomes or trisomes can occur are given by the coefficients of the terms of $(a + b + c \ldots)^n$, in which the elements of the multinomial represent the individual members of the genome, and n represents the number in the sample. The number of ways that a complete sample could occur is the sum of the coefficients of all terms that contain a complete set of the assigned letters. Since the species in which these chromosomal anomalies are tolerated are generally polyploids, the multinomial may have many elements; since the power to which the multinomial must be raised for the inclusion of many complete samples must be high, the necessary calculations are tedious. One method described by Bizely for securing the desired value to any desired accuracy can be adapted to this cytogenetic problem. The general term for the number of ways that n aneuploids can include n_a, n_b, n_c, individuals of aneuploids a, b, and c, is $\frac{n!}{(n_a!)\,(n_b!)\,(n_c!)\,\ldots}$. The number of ways in which no member is absent is, therefore, the coefficient of x^n in $n!\left(\frac{x^1}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\frac{x^4}{4!}\ldots\right)^g$ in which g is equal to the genome number. This is identical with the coefficient of x^n in $n!(e^x-1)^g$. The coefficient of x^n, therefore, is the number of ways that complete samples can occur with specified numbers in the sample. If the number of chromosomes in the genome is low, approximately ten, nine samples in ten will have a complete set if the sample includes four times as many individuals as chromosomes in the genome. If the genome number is high, approximately 20, five times the genome number is necessary for approximately the same result. The probabilities may be secured by dividing these numbers by g^n."

1331 Gerassimova-Navashina, H.
A contribution to the cytology of fertilization in flowering plants.
Nucleus, Calcutta 1960 : **3** : 111–20.

The author gives an account of her views upon the nature of fertilization [cf. XXIX, 986 and XXX, 3570].

1332 Sampson, D. R.
(An hypothesis of gene interaction at the *S* locus in self-incompatibility systems of angiosperms).
Amer. Nat. 1960 : **94** : 283–92.

Self-incompatibility systems controlled by multiple alleles at a single locus are considered. Three types of *S* allele action are known: (*a*) partial or complete dominance of one allele over another; (*b*) mutual weakening of the activities of the two alleles; and (*c*) independent action or the apparent absence of interaction. In the postulated reaction system, each *S* allele governs the production of a specific incompatibility substance, which must be present in a certain threshold quantity to cause incompatibility, and heterozygotes produce two substances, one for each *S* allele. Independent action occurs in the heterozygote if the two substances are produced in above-threshold quantities. Dominance is the result of unequal competition between the two reaction systems for some factor in limited supply. "Nonlinear dominance relations can occur in populations because super-threshold quantities of incompatibility substances, although unequal, have equal potency in heterozygotes. Mutual weakening is attributed to secondary limits that apply to the activities of only certain *S* alleles." There seem to be moderate limits to *S* allele action in the pollen in sporophytic systems but more restrictive limits in the gametophytic systems of artificial tetraploids. In the stigmas of sporophytic systems, there are thought to be moderate limits to *S* allele activity and there appear to be no detectable limits in gametophytic systems; these differences are related to the number of cells involved in inhibition, this being greater in the gametophytic systems.

Structure and function of genetic elements. Brookhaven Symposia in Biology 1959 : No. 12 : Pp. 187.

1333 *Doty, P., Marmur, J. & Sueoka, N. The heterogeneity in properties and functioning of deoxyribonucleic acids.* (*pp. 1–16*).

Studies of denaturation temperature utilizing absorbance-temperature curves and of density using the band profiles obtained by density-gradient ultracentrifugation have provided information on the degree of heterogeneity of DNA in samples from diverse sources. There appears to be a progressive increase in heterogeneity of base composition of DNA in the sequence bacteriophage → bacteria → vertebrates. However, the variance of molecular composition about the mean values is relatively small in vertebrates compared to the situation in bacteria. In view of the comparative uniformity of many bacterial metabolic processes, the wide variation in mean composition of DNA, implying practically no DNA molecules with common composition at a density difference of 1·01, is surprising.

1334 *Rich, A. Polynucleotide interactions and the nucleic acids.* (*pp. 17–26*).

Experiments showing the formation of two and three-strand helical complexes in solutions of pure or mixed synthetic polyribonucleotides are reviewed. The significance of these observations for theories of nucleic acid replication and transfer of information from DNA to RNA is considered.

1335 *Sinsheimer, R. L. A single-stranded DNA from bacteriophage ΦX174. (pp. 27–34).*

The DNA of the above virus has been shown to contain one strand only and to lack complementarity in its base ratios.

1336 *Crick, F. H. C. The present position of the coding problem. (pp. 35–39).*

The difficulties of devising a code for transfer of information from DNA are reviewed, in particular the difficulty of explaining the extensive range in microorganisms of the ratio (guanine + cytosine)/(adenine + thymine) in the DNA compared with the comparative invariance of the base composition of the RNA.

1337 *Hoagland, M. B. The present status of the adaptor hypothesis. (pp. 40–46).*

The evidence in favour of the hypothesis that aminoacids combine with specific small polynucleotides (adaptors) and that the latter locate the aminoacids in the correct position for protein synthesis by complementary base pairing with particulate template RNA is reviewed.

1338 *Brown, G. L., Brown, A. V. W. & Gordon, J. DNA mediation in protein synthesis. (pp. 47–62).*

Experiments designed to trace the stages of phage protein synthesis in protoplasts of *Escherichia coli* infected with T2 phage and to isolate soluble RNAs specific for transfer of particular aminoacids are described.

1339 *Freese, E. On the molecular explanation of spontaneous and induced mutations. (pp. 63–75).*

From a study of the effect of mutagens on T4 phage, it is inferred that most reversible point mutations correspond to change of a single nucleotide pair. Two classes of mutant are distinguished. In the first, caused by base analogues such as 5-bromouracil, 2-aminopurine and 2,6-diaminopurine, the number of purines and pyrimidines in each DNA chain remains unaltered. In the second, caused by reagents which alter the DNA bases, in particular nitrous acid, purines are exchanged for pyrimidines and *vice versa*.

1340 *Levinthal, C. Genetic and chemical studies with alkaline phosphatase of* E. coli. *(pp. 76–85).*

All thirteen ultraviolet-induced mutants completely negative for alkaline phosphatase activity were found to be localized in a small region (recombination frequencies 0·008–0·25%). Assuming that the mutants are distributed at random over the phosphatase gene, the length of the latter is *ca.* 0·3% recombination units. Each identical subunit of phosphate contains *ca.* 400 aminoacids, so 1200 aminoacids correspond to 1% recombination frequency. Assuming that 1% recombination frequency corresponds to *ca.* 5000 DNA nucleotide pairs, the coding ratio should be 4 nucleotide pairs : 1 aminoacid.

1341 *Brenner, S. & Barnett, L. Genetic and chemical studies on the head protein of bacteriophages T2 and T4. (pp. 86–94).*

A study of the electrophoretic fingerprints of the tryptic digest of head proteins of mutants (o) resistant to osmotic shock revealed a very close linkage between o and p_3, on one side, and $p_1^+p_2^+$ on the other, determining aminoacid sequence in the head protein.

1342 *Luria, S. E. Genetic transfers by viruses. (pp. 95–102).*

Recent views on the nature of transduction and allied phenomena are considered. The author recapitulates his unified interpretation of transduction and conversion previously summarized [XXIX, 3352].

1343 *Steffensen, D. A comparative view of the chromosome. (pp. 103–24).*

Recent work on the number of strands composing the chromosome and on the nature of the bonds between the micromolecules of the chromosome is reviewed. An account is also given of the author's own investigations on the role of divalent metals in chromosomes [cf. XXX, 2256 and 3577].

1344 *Weigle, J. & Meselson, M. Modified density of transducing phage lambda. (pp. 125–33).*

Phage λdg can multiply in the presence of λ in *Escherichia coli* 'KD' but not in its absence. Density-gradient centrifugation of lysates containing λdg has shown that, while the density of λ is constant, that of λdg varies with the lysate, sometimes exceeding and sometimes being less than that of λ. This behaviour is explained by assuming a loss of phage-specific DNA by λdg accompanied by nonreciprocal acquisition of host-specific DNA.

1345 *Swift, H. Studies on nuclear fine structure. (pp. 134–52).*

Electron-microscopy studies of three types of animal tissue have provided evidence that RNA is contained in particles of the nucleolus chromosomes, the interstices between the chromosomes and the cytoplasm. No satisfactory evidence of transfer of particulate material from nucleus to cytoplasm was obtained.

1346 *Woods, P. S. RNA in nuclear-cytoplasmic interaction. (pp. 153–74).*

Experiments on the incorporation of tritium-labelled cytidine in the root meristems of *Vicia faba* are reported. Labelled RNA first appears in two regions: the nuclear chromatin and the nucleolus. Only later does labelled RNA appear in the cytoplasm, possibly moving out from the chromosomes via the nucleolus.

1347 Fresco, J. R., Alberts, B. M. & Doty, P.
Some molecular details of the secondary structure of ribonucleic acid.
Nature, Lond. 1960 : **188** : 98–101.

Evidence is put forward for the hypothesis that RNA consists of a single-stranded molecule in which the base chain is folded into a series of hairpin-like helices in which the usual base pairing by hydrogen bonding takes place, the bases for which no partner is available being extruded as loops.

1348 Shapiro, H. S. & Chargaff, E.
Severe distortion by 5-bromouracil of the sequence characteristics of a bacterial deoxyribonucleic acid.
Nature, Lond. 1960 : **188** : 62–63.

When 5-bromouracil is added to the medium on which the thymine auxotroph of *Escherichia coli* 'I' is grown, it is absorbed in amounts which quantitatively replace thymine. However, when the DNA of normal *E. coli* and the strain with intruded 5-bromouracil is hydrolysed with 0·1 M H_2SO_4, the frequencies of pyrimidine nucleoside diphosphates and dinucleoside triphosphates are very different in the two cases, in particular the number of solitary pyrimidine units practically doubles when 5-bromouracil is added. It thus appears that 5-bromouracil has drastically modified the sequence characteristics of the DNA.

1349 Brewbaker, J. L.
Biology of the angiosperm pollen grain.
Indian J. Genet. 1959 : **19** : 121–33.

Attention is drawn in this review to the taxonomic significance of whether the pollen grains are shed at the binucleate or trinucleate stage, information on the cytology of the pollen being summarized for 199 families. Binucleate grains germinate readily *in vitro*, store well and are characteristic of incompatibility systems of the gametophytic type. In contrast, trinucleate grains germinate at best only poorly *in vitro*, seldom retain viability longer than a few days, and characterize the sporophytic type of incompatibility. Other aspects discussed include pollen cytogenetics and pollen dispersal in relation to physiological differences between binucleate and trinucleate grains.

TAXONOMY

1350 Rogers, D. J. & Tanimoto, T. T.
A computer program for classifying plants.
Science 1960 : **132** : 1115–18.

The application of the electronic computer to taxonomy is described, an analysis of cultivars of *Manihot esculenta* being given as an example.

CROP PLANTS

1351 **Colonial Research 1958-59. Annual Report of the Colonial Research Council, London 1959** : Pp. 419.

The report for the Committee for Colonial Agricultural, Animal Health and Forestry Research includes brief accounts of the chief projects being carried out on crop breeding in the different countries served by the Colonial Research Council of the British Commonwealth.

1352 **Colonial Research 1959-60. Annual Report of the Colonial Research Council, London 1960** : Pp. 381.

The report includes brief accounts of the chief crop breeding projects being carried out in the different countries served by the Colonial Research Council of the British Commonwealth.

Report of the Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian 1960 : Pp. 105.

1353 *Director's report. (pp. 5–21).*

Oats. Trials on the performance of locally-selected lines, as compared with lines selected in other areas, have continued at centres in Argyll and Inverness-shire and at Pentlandfield, Midlothian [cf. XXX, 112]. It was evident that selections made in the difficult Argyll and Inverness-shire environments were relatively more successful at their respective centres of origin than the other lines which had been selected under environments prevailing elsewhere. Moreover, the lines which gave the highest grain yield at these two centres were also those which produced the greatest bulk of straw. This indicates that the short-strawed, high grain-yielding types which are successful at Pentlandfield are not the best adapted for the Argyll and Inverness-shire environments.

About 1000 seedlings, highly resistant to oat stem eelworm (*Ditylenchus dipsaci*), have been retained for multiplication and field trial. The relative virulence of four Scottish eelworm races was tested. The most virulent was a strain collected at Burdiehouse, near Edinburgh; however, it was noted that resistant oat selections withstood attack by this race. A high degree of resistance has been found in six lines of *Avena byzantina*, five from Greece and one from Turkey, as well as in two Spanish lines of *A. sterilis* and the variety Algerian (Red).

Herbage plants. Further genecological investigations on hill species have been carried out. Methods for estimating lead tolerance of *Festuca ovina* are discussed. A preliminary study of virus diseases in herbage grasses has commenced.

Brassica. The advent of Canson, a relatively uniform variety of thousand-headed kale, has drawn attention to the great variation in characters shown by some other commercial varieties of the crop. A study has been conducted on the side-shoot development, height, stem weight and leaf weight of progenies from a number of selections. Crosses between thousand-headed kale and spring cabbage have reached the F_2 generation but so far there has been little segregation of valuable types. Most of the plants resembled loose cabbages, though some hearted more strongly. Early bolting appears likely to be a drawback in this cross.

A number of interspecific crosses have been attempted involving *B. oleracea*, *B. campestris*, *B. napus*, *B. carinata* and *B. hirta*. Many crosses were unsuccessful, while others yielded only maternal-type plants. Progeny of the cross *B. napus* ($2n = 38$) x *B. campestris* ssp. *nipposinica* ($2n = 20$) was examined at mitosis; counts of $2n = 29$ were obtained. At meiotic metaphase I, ten bivalents and nine unpaired chromosomes were found. Such pairing is to be expected in view of the fact that *B. napus* is an amphidiploid and already contains chromosomes derived from *B. campestris*. Hybrids between typical *B. campestris* and its oriental forms, ssp. *chinensis*, *pekinensis* and *nipposinica*, showed only bivalents at meiotic metaphase.

A number of polyploids were produced by means of colchicine. The autotetraploid of *B. hirta* ($2n = 48$) showed varying degrees of tetravalent formation at meiotic metaphase I in pollen mother cells. On the whole, chromosome pairing was good and in some cells only bivalents were observed. Autotetraploid *B. campestris* ($2n = 40$) also showed fairly good pairing, the number of bivalents per cell ranging from 16 to 18. A similar range of pairing was noted in autotetraploids of the three oriental subspecies of *B. campestris* mentioned above. Pollen fertility was between 80 and 98% in all autotetraploids examined.

Various wild types of *B. oleracea* and *B. campestris*, originating in the Mediterranean area, were grown for observation. They appeared to hold little promise as fodder plants. Two cultivars of *B. campestris* ssp. *nipposinica* (= *B. japonica*) proved to be of interest. They developed rapidly and formed large rosettes with many, rather finely dissected leaves.

Potato. Breeding for field resistance to blight has continued. About 270 seedlings which had survived screening tests with race 1,2,3,4 were grown in field plots to assess their economic potentiality and to expose them to the disease under natural conditions. No symptoms were however observed owing to unusually dry conditions. Samples of a number of these seedlings were grown in Toluca, Mexico, and it was noted that not all remained resistant to race 1,2,3,4. It is suggested that an additional gene for hypersensitivity, R_5, was present in the seedlings susceptible in Mexico but hypersensitive in Scotland. The most promising seedlings originated from interspecific hybrids involving *S. demissum*, *S. phureja* and *S. simplicifolium*.

Data are given on the resistance of 12 species of *Solanum* to the Duddingston and Boghall races of the potato root eelworm, *Heterodera rostochiensis*.

Breeding for resistance to viruses has continued. Out of 4000 seedlings tested for susceptibility to viruses X and Y under greenhouse and field conditions, 261 remain and have been carried forward for further trial.

In trials conducted at three centres, Pentland Crown was the variety least affected by both leaf roll and virus Y. Of 44 lines of *S. demissum* tested for their reaction to viruses A and Y, 3 were found to be homozygous for the gene controlling necrotic response to both viruses, 29 were homozygous for necrotic response to virus A only and 8 had a non-necrotic response and were susceptible to both viruses. The remaining 4 lines were heterozygous.

Sugar beet. A selection programme, in co-operation with the National Institute of Agricultural Botany (NIAB), has been conducted. Following the practice of continental breeders, seed of two outstanding families, Logie-5 and Logie-F, has been mixed with three families derived from a Cambridge strain. The mixture has been included in 1959 trials arranged by the NIAB. Attempts to combine large foliage, high-yielding ability and high resistance to bolting have thus far proved unsuccessful although one family, ENBL–18, has given very promising results as regards the last two characteristics.

1354 *Black, W. Races of* Phytophthora infestans *and resistance problems in potatoes.* (*pp. 29–38*).

The Scottish Plant Breeding Station has established a differential host series of 16 genotypes, based on the *Solanum demissum* genes, R_1, R_2, R_3 and R_4 and capable of identifying 16 different races of *Phytophthora infestans*. These genes are capable of inducing a hypersensitive response to infection with appropriate races of the pathogen.

Evidence is reviewed which illustrates that *S. demissum* probably contains six *R* genes which, in their different combinations, would be capable of distinguishing 64 different races. Less than half this number of races have been identified. Blight surveys have indicated that the number of races varies greatly from country to country. It tends to be low where only *S. tuberosum* varieties occur and increases as varieties possessing *R* genes are brought into cultivation.

1355 *Dunnett, J. M. The role of* Solanum vernei *Bitt. et Wittm. in breeding for resistance to potato root eelworm* (Heterodera rostochiensis *Woll.*). (*pp. 39–44*).

In this review, the significance of the polygenic resistance possessed by *S. vernei* is discussed.

1356 *Davey, V. McM. Notes on the botanical characters of some rape types.* (*pp. 45–58*).

A number of botanical characters of giant and dwarf rape were examined, using certified varieties from New Zealand as controls for comparison purposes. It was noted that New Zealand giant rape (type 1) bolted considerably when sown in early May, while a British variety of the same type bolted to a far lesser extent. On the other hand New Zealand Broad-leaved Essex, a type 2 dwarf rape, was much more resistant to bolting than a British dwarf variety and a Dutch variety, Margo.

Differences in leaf weight were insignificant but the New Zealand giant had heavier stem weights than the others. Plants of the dwarf varieties remained short-stemmed unless they bolted but giant types showed some lengthening of stem while their foliage was still vegetative.

A New Zealand clubroot-resistant variety showed more rapid and complete bolting than any of the above and its long stems were heavier than those of dwarf rape. No plants of this variety had disease nodules when grown in boxes of clubroot-infected soil, whereas 22–38% of plants of the other varieties showed disease symptoms.

1357 *Clausen, J. A simple method for the sampling of natural populations.* (*pp. 69–75*).

The principles of the sampling method adopted by the Carnegie Institute Department of Biology, Stanford, Calif., for genecological studies are outlined. The method, for sampling wild populations, is based on the mass collection of seeds followed by the growing of generous samples of plants from these seeds. The advantages of the technique over the direct transplantation method are discussed.

1358 *Wilkins, D. A. The measurement and genetical analysis of lead tolerance in* Festuca ovina. (*pp. 85–98*).

Vegetative samples of *F. ovina* were collected from several populations in each of the chief lead-mining areas of Britain, and tested for tolerance to lead [cf. XXVIII, 583]. There was no evidence of a clear division between tolerance and nontolerance, nor, on the other hand, was there a completely continuous range between the two extremes. It is suggested that more than one type of tolerant plant may exist. Studies on the progeny of a number of crosses indicated that tolerance was dominant over medium and nontolerance, while medium tolerance was dominant over nontolerance. It was evident that the results of these and other tests could not be attributed to the existence of a simple major gene with two alleles. However, there was insufficient evidence to establish how many alleles were involved; whether these were present at more than one locus; or whether the number of loci was so large that the system could be described as polygenic.

1359 *Gilmour, J. S. L. The deme terminology.* (*pp. 99–105*).

A brief account is given of the principles on which the deme terminology is based. The ten basic terms, and a number of derivative terms, are defined [cf. XXIV, 2623].

1360 **Twenty-eighth Annual Report of the Minister for Agriculture, Dublin 1958-59** : Pp. 167 + 85.

Wheat. At the Cereal Station, Ballinacurra, Co. Cork, further crosses were effected between spring varieties and more recent types superior in milling and bread-making qualities and in resistance to such diseases as *Cercosporella* eyespot, mildew and stem and leaf rusts. Selections from the stem-rust resistant hybrid Redman x Hybrid 27 and from the progeny of neutron-treated Atle were compared with Atle and Atson in a small-scale experiment. One Redman x Hybrid 27 selection free from mildew and yellow rust and 12 days earlier in date of ripening than Atle was selected for crossing with other varieties.

Barley. Crosses developed at Ballinacurra and commercial varieties such as Herta, Proctor, Provost and Carlsberg, as well as progenies with X-ray induced mutant XC–11 [cf. XXX, 126] in their pedigrees, were further selected. In an attempt to combine the useful features of XC–11 with high yield and other desirable characters, hybridization was initiated between Hunter x XC–11 selections and commercial wheats. A selection of Spratt-Archer x Kenia 17/8 has been named Hunter and is being propagated with a view to its release as a malting variety.

Grasses. Progress was made in breeding of ryegrass and cocksfoot.

Potato. Breeding for disease resistance and other characters continued at the Potato Breeding Centre in Donegal.

1361 *Report of the Agricultural Department, University College, Dublin, for the year 1958–59. (pp. [1]–[20]).*

Wheat. The winter wheat Glasnevin Rosa has been crossed with numerous varieties in the hope of securing an even better type with short straw and resistance to the new race of yellow rust [XXX, 127].

Oats. Blenda, W16004, Minor, Palu and particularly selections of Minor x Pendek and Glasnevin Triumph x Major gave a good performance in a season when lodging was generally severe; these types will be used in breeding. Minor x Pendek has yielded derivatives with the shortest straw but these have been only average in grain quality. Selections with outstandingly good quality have however been obtained from Glasnevin Triumph x Major.

Barley. The material selected included early generations of Proctor x Spratt-Archer 37/3, Proctor x Drost, Proctor x Beorna, Carlsberg x Proctor and Maythorpe x Carlsberg.

Grasses. Strain building in perennial ryegrass, cocksfoot and timothy is in progress.

Brussels sprouts. Varieties and strains developed at the Agricultural Department gave a good performance at trial centres in England and Scotland, the market types Irish Elegance and 73/53 and freezing variety Irish Glacier being outstanding [cf. XXX, 127].

Fiftieth Annual Report of the John Innes Horticultural Institution, Bayfordbury, Hertford 1959 : Pp. 49.

1362 *Williams, W. Department of Plant Breeding. (pp. 7–16).*

Some aspects of the selection of parents and the determination of optimum family size in top-fruit breeding are discussed.

Cherry. Studies on the genetics of bacterial-canker (*Pseudomonas mors-prunorum*) susceptibility have commenced. The effects of 13 strains of the pathogen on the susceptible variety Bigarreau Napoleon were examined; wide variations in strain virulence were noted. Twenty-eight varieties, classified according to the severity of natural infection, were found to fall into four well-defined groups.

Strawberry. Work has continued on the cytogenetics of intraspecific and interspecific crosses in the genus *Fragaria*. Of the five species studied, only *F. nipponica* and *F. nubicola* were self-sterile. *F. nilgerrensis* was largely incompatible with the other species, although viable F_1 hybrids were obtained from a cross between it and an east European form of *F. vesca*. Crosses with other forms of *F. vesca*, however, were unsuccessful, suggesting the presence of genetic variation within that species. The species *F. nubicola* and *F. nipponica* were fully interfertile, and showed partial compatibility with *F. vesca*. All the F_1 hybrids examined had a diploid chromosome number of 14 and chromosome pairing was normal. Chiasma frequency was slightly greater than one per bivalent and was identical to the frequency found in the parental species.

Allium. A study of caryotypes of *Allium* species has been carried out. The presence of a single supernumerary chromosome in some polyploid forms of *A. angulosum*, *A. nutans* and *A. senescens* has been confirmed.

Tomato. Neither day length nor soil nitrogen level were found to influence the amount of recombination between four marker genes, *d*, *p*, *o* and *s* (chromosome 2) [cf. XXX, 129]. The influence of the gene background and of sex on recombination was studied, using four different F_1 families: *d p o s* x *Lycopersicon pimpinellifolium*; *d p o s* x *L. esculentum*; and the two reciprocal crosses. The frequency of recombination differed between male and female gametes. The F_1 hybrids, when used maternally in back crosses with the multiple recessive parent, showed a significantly greater recombination frequency than in the reciprocal combinations. Different chromosome regions also showed significant differences in recombination frequencies.

All four recessives were slightly lethal in the homozygous phase. The homozygotes *dd* and *pp* showed the greatest deficiency; however, a comparison of cross-over classes indicated that most of the deficiency in the *pp* class was due to close linkage with *d*. The region marked by *s* (compound inflorescence) interacted with each of the regions marked by *d*, *p* and *o*, giving a significantly greater deficiency in the multiple-recessive classes.

In an analysis of heterosis for yield in the tomato, three F_1 hybrids and their parents were studied for variations in five characters, flower number, date of first flower, average fruit weight, fruit number and yield of fruit. None of the hybrids exceeded the better parent in any of the characters with the exception of yield in which all three hybrids exceeded the higher yielding parent [cf. XXIX, 291].

A study on the genetics of resistance to tobacco mosaic virus has been initiated. The material being used consists of two lines with resistance derived from *Lycopersicon hirsutum* and a third whose resistance is believed to have multiple origins in *L. peruvianum*, *L. hirsutum* and *L. pimpinellifolium*.

1363 *Department of Genetics*. (*pp. 17–24*).

Studies on the structure of the A mating-type locus in *Coprinus lagopus* and on heterocaryon formation and nuclear migration are reported.

The results of a study of mitotic crossing over in *Ustilago maydis* are presented.

Genetic evidence for diploidy in *Ustilago* was confirmed by DNA estimation in two diploid and two haploid strains.

In studies on seed storage, a number of adverse effects on yield and other characters were observed in plants grown from seed which had been in prolonged storage. A test on radish seeds indicated that these effects could, to some extent, be transmitted to the succeeding generation. It is stated that "valid comparisons of the performances of strains of a plant may only be made if seed comparable as to age and storage is available. Carry-over effects and probable genotype-storage interactions complicate the situation by adding a further measure of pseudo-genetic variability."

1364 *Simmonds, N. W. Department of potato genetics*. (*pp. 25–31*).

An investigation of failure to set fruit in *Solanum acaule* ($2n = 48$), *S. demissum* ($2n = 72$) and *S. stoloniferum* ($2n = 48$) is reported. A comparison of berry and seed set between naturally self-pollinated and hand-pollinated flowers showed that self pollination is only half as effective as hand pollination in *S. acaule*, and about three-quarters as effective in the case of *S. demissum* and *S. stoloniferum*.

In further studies in the series *Conicibaccata*, *Demissa*, *Longipedicellata* and *Piurana*, two heptaploid hybrids ($2n = 84$) were produced. *S. fendleri* x *S. demissum* and *S. fendleri* x *S. guerreroense* hybrids were very vigorous and, although meiosis was irregular, produced good pollen and set berries unaided.

Hexaploids were produced by application of colchicine to the triploid hybrid species *S. vallis-mexici* and to the triploid hybrids of *S. verrucosum* ($2x$) x *S. stoloniferum* ($4x$). These hexaploids crossed readily with all the hexaploid *Demissa* species (except *S. guerreroense*) although they did not resemble them morphologically. The most fertile progenies were obtained by crossing with *S. demissum* and *S. hougasii*, which suggests that these species are more closely related to each other than to *S. brachycarpum* or *S. guerreroense*, and that they may have originated as amphidiploids of *S. verrucosum* and *S. stoloniferum* or from closely related hybrids.

Further selections have been carried out in a programme designed to combine desirable commercial characteristics with at least two *R* genes and resistance to virus Y. The factor for resistance to the virus, derived from *S. stoloniferum*, proved effective even after several back crosses to domestic types; this contrasts with other sources of virus Y resistance, such as the hypersensitivity of *S. demissum*, which "tend to lose penetrance in a *S. tuberosum* background."

A number of lines of *S. tuberosum* ssp. *andigenum* have shown considerable resistance to *Streptomyces scabies* and are undergoing further investigation.

Two-locus incompatibility systems have been found in *S. ehrenbergii*, *S. pinnatisectum* and *Physalis ixocarpa*. The differences between two-locus and one-locus systems are discussed.

Studies have shown that *Abutilon hybridum* has a one-locus self-incompatibility system of the *Nicotiana* type; five *S* alleles have been identified. However, although all plants were highly self-sterile, some intragroup crosses showed sufficient pollen growth to allow a few seeds to set, while some perfectly compatible crosses set few or no seed. There was also considerable late-season pseudocompatibility. This erratic seed setting could be interpreted in terms of (*a*) polygenic modifiers of the pollen-style reaction and (*b*) deleterious recessive homozygotes. Segregating in the same families, but apparently independently of the *S*-locus, are genes that affect style length. Styles could be classified (approximately) as long and short; the shorts selfed naturally while the longs did not. Hence the shorts alone set abundant fruits in the season of pseudocompatibility. The shorts were generally more fertile than the longs, setting some 50% more seed per fruit, although there was no difference between them in ovule number or pollen fertility. This suggests that long-style genes are linked to deleterious recessives, the elimination of which is reflected in reduced fertility. It appears as if the style-length system may turn out to provide a significant feature of the mating system ancillary to the action of the *S* locus.

Irradiation of young buds of *S. megistacrolobum* has been used in an attempt to induce *S* mutations.

During the year, 148 new collections of *Solanum* spp. were received; 77 of these were Bolivian cultivars from the University of San Simon, Cochabamba. The chromosome numbers of four species have been recorded as follows: *S. michoacanum*, *S. brachistotrichum* and *S. clarum*, all $2n = 2x = 24$; and *S. agrimonifolium*, $2n = 4x = 48$.

1365 *Department of cell biology.* (*pp. 32–40*).

Using the anthers of *Tradescantia bracteata* as material, studies have been conducted on the fine structure of chromosomes between metaphase and anaphase.

Studies on interphase nuclei from root meristems of *Vicia faba* and *Allium cepa* indicated that arginine content, like that of DNA, is regularly doubled during interphase in preparation for the next mitosis. It appeared also that the synthesis of the two compounds during interphase took place simultaneously, or at least with a positive time correlation. In *V. faba* the synthesis of both compounds occurred during the middle third of interphase.

Arginine residues appear to be fixed to the acidic groups of DNA and may act as bonds between this nucleic acid and the protein of the chromosomes.

A method is described for the isolation of plant nuclei from small pieces of tissue such as root meristems.

Conditions of DNA synthesis in the euchromatic and heterochromatic regions of the chromosome have been compared, using as material *Fritillaria lanceolata* and *Scilla sibirica*. The results indicated that DNA synthesis proceeds sequentially along the chromosome from the ends, with equal facility in euchromatic and heterochromatic segments. The time taken for incorporation of the labelled compound along the length of the chromosome was considerably shorter than the duration of DNA synthesis. This result is regarded as supporting the hypothesis that the chromosome is multistranded, with each strand reproduced separately.

1366 Fortieth Report and Accounts of the National Institute of Agricultural Botany 1959 : Pp. 63.

Information is provided on the main results of variety trials carried out on cereals, forage grasses and legumes, *Brassica* fodder crops, potatoes, sugar beet and vegetables at the National Institute of Agricultural Botany and subsidiary centres in the United Kingdom.

1367 Thirtieth Annual Report of the University of Birmingham Research Committee, 1958-1959 : Pp. 123.

Polygenic inheritance. Further mathematical study has suggested a new way of estimating the number of effective factors involved in the genetic determination of continuous variation and also the magnitude of the effect produced by segregation of the most powerful of these factors. It remains to be ascertained whether this approach can be applied successfully in practice.

Fungi. The interaction of nucleus and cytoplasm in *Aspergillus* has been further studied. "A mutant particle maintains itself in easy equilibrium in the cytoplasm when associated with a wild type nucleus. But when a mutation to adenine requirement was induced in this self-same nucleus the capacity for cytoplasmic equilibrium was lost, with the mutant particle tending to diminish in the cytoplasm so that it could be maintained only by heavy selection."

Further studies of biochemical mutants of *Neurospora* have disclosed several more cases of physiological diversity among alleles. This diversity has usually been evident through complementation, the pattern of which is complex at four histidine and two arginine loci and at *tryptophane*–3. No complementation has however been found for several loci, including *histidine*-6, where 95 alleles have been tested in all combinations. The complementation and recombination maps of *methionine*-2 have so far shown colinearity.

A method, using mycostatin and replica plating, has been devised for the enrichment and isolation of auxotrophic mutants of *Saccharomyces cerevisiae* and *Schizosaccharomyces pombe*, following exposure of suspensions to ultraviolet radiation. The mutants are being used to construct chromosome maps of the two species and to investigate the fine structure of the gene.

Solanum. Investigations on the nature of frost tolerance in different species have been extended to include correlation of events observed by microscopic examination of freezing petioles with the time curve of heat production as ice forms in the tissues under observation [cf. XXX, 128]. Frost tolerance is favoured if the initial formation of ice is rapid and within the intercellular spaces, so that each cell is adjacent to some ice. Solutes may then be released from cells, causing the ice to thaw. On further cooling, ice reforms in the flooded tissue near the exterior of the organ, without causing serious damage.

Serological work on the tuber-bearing species collected during an expedition to Mexico and Central America [cf. *loc. cit.*] is in progress with a view to increasing information on relationships and evolution within the genus [cf. XXX, 2867].

Research on the population genetics of *Phytophthora infestans* has been initiated in the hope of elucidating the nature and origin of the changes by which the pathogen is able to attack resistant varieties.

1368 **Report of the Agricultural Research Council, London, for the year 1958-59** : Pp. 213.

The report includes brief accounts of the work carried out by institutes and stations in the United Kingdom at which crop breeding and genetical research are being carried out. In a section entitled Some aspects of agricultural research, special topics are singled out for discussion, among them Biometrical genetics and plant breeding and Controlled environment facilities for plant research.

Report of the Welsh Plant Breeding Station, University College of Wales, Aberystwyth 1959 : Pp. 119.

1369 *Cooper, J. P. Developmental genetics. (pp. 15–20).*

Response to selection for date of ear emergence in Irish and Kent ryegrass [cf. XXIX, 45] has continued to the F_5; genetic variation still exists within the selection lines. Low fertility continues in some lines. The genetic control of dry-matter production under controlled competition and defoliation was studied and varietal differences noted. High estimates of heritability were obtained for tiller number, dry weight of tiller and dry weight of plant in Italian, Irish and Hunsballe ryegrass.

Quantitative differences were found in the carbohydrates, nitrogen content, aminoacids and other organic acids in four genotypes of perennial ryegrass, two each of S24 and S23. Heritability and response to selection will be investigated. Tests of resistance to Dalapon in Danish, Brage, S37 and S143 cocksfoot varieties revealed no varietal differences in susceptibility although a few resistant plants occurred in each.

Three categories of white clover are distinguished: (1) with low uptake and low requirement of calcium, e.g. S100, (2) with high uptake and high requirement, e.g. Dutch, and (3) with high uptake and comparatively low requirement, e.g. Ladino. Varietal differences in resistance to aluminium toxicity are recorded in some perennial ryegrass varieties.

1370 *Beddows, A. R. Grass breeding. (pp. 21–27).*

The data presented indicate that, as far as the hay cut is concerned, the most efficient number of plants for a synthetic perennial ryegrass variety is considerably less than was originally thought desirable. Studies on leaf development in the Gramineae suggest that blade length and width may be inherited independently.

1371 *Ellis Davies, W. Legume breeding. (pp. 28–32).*

Data were collected on spread, plant height, leaf size, flowering date and weight in 60 selected white clover populations from various countries. Mediterranean plants fell into the large-leaved group, northern or high altitude plants in the small-leaved group, and plants from Normandy and New Zealand in the medium-leaved group. Types now used in Britain appear to have been derived from the last group. Differences were observed in time of flowering with a trend to lateness in northern populations; the range of flowering however was less than in red clover.

From studies on seed setting in diploid and tetraploid red clover it is suggested that the longer corolla tube of the tetraploids may contribute to poor pollination of such plants in the field. Irregularities noted between fertilization and full embryo development are thought to be due to an ineffective endosperm.

1372 *Griffiths, D. J. Cereals, beans and* Brassicae *breeding. (pp. 33–42).*

Oats. E2296 and E2297 are two new stiff-strawed lines, both of which are resistant to stem eelworm and mildew. The resistance to stem eelworm noted in certain forms of *Avena sterilis* has been successfully transferred to *A. sativa* types. Attempts were made to improve quantitative characters in the winter oats S147 (excessive straw length) and S172 (below-average grain size) by irradiation with X rays and γ rays from a Co^{60} source. Some interesting types were isolated but none outyielded the original parents.

Rye. A comparison of forage production in various rye stocks showed central European stocks to be superior, growing at low temperatures and maintaining steady growth through early spring. A breeding programme to develop higher tillering varieties able to respond to early dressings of nitrogen has begun.

Forage kales and rapes. Five strains of thousand-head kale grown at upland and lowland centres revealed no differential varietal response to the two sets of conditions. Hybridization between locally adapted rapes and introduced strains resistant to *Plasmodiophora brassicae* improved yields on infested soil.

1373 *Evans, G. Seed multiplication. (pp. 52–60).*

Although the number of elongated internodes per stem is a useful character in distinguishing red clover varieties [cf. XXIV, 1181], it now appears that this is of use only in dealing with material grown under short days. Late-flowering varieties grown under continuous long days do not differ appreciably from early-flowering types grown under the same conditions.

A high correlation was found in uncut material in the first harvest year between number of tillers in the basal rosette at the advent of the critical day length and numbers of stems at full bloom. Selection for head production on the basis of rate of tillering in the seedling is therefore suggested.

Seedling growth habit at the 6-leaf stage and also simple leaf area may be useful in differentiating red-clover varieties.

1374 *Carr, A. J. H. Plant pathology. (pp. 61–67).*

Dactylis. Among cocksfoot genotypes, marked differences in susceptibility to cocksfoot streak virus were noted.

Lucerne. Of nine *Medicago* species, including one natural *M. sativa* x *M. falcata* hybrid, tested for resistance to *Verticillium* wilt, all except *M. platycarpa* had better resistance than *M. sativa* 'du Puits'; the hybrid was most resistant. The hybrid was tetraploid, but tests on diploid and tetraploid *M. falcata* showed the diploid material to be more resistant. It is concluded that races of *M. falcata* may differ in resistance to *Verticillium* but this is probably not related to ploidy.

1375 *Jones, K. Cytology. (p. 68).*

The cytological survey of FAO collections of *Dactylis* species is complete and a list of chromosome numbers is available. FAO lot 3076 from Cyrenaica is hexaploid; this is the first naturally occurring material to be recorded with this number. At meiosis chromosome pairing was regular; although quadrivalents, sexivalents and some higher multivalents occurred, univalents were rare. Multivalent frequency was low and plants should be of good fertility.

Chromosome counts made on 17 collections of *Agropyron repens* from various parts of England and Wales showed all plants to be hexaploid ($2n = 42$).

Statistical analysis of a randomized block designed to compare the morphology of $4x$, $5x$ and $6x$ *Holcus mollis* shows that none of the numerous characters measured can be used to separate the chromosome races in the field. They must therefore be included in a single taxon. There is evidence that the pentaploid is of hybrid origin.

Similar analyses made on *H. lanatus* ($2n = 14$), *H. mollis* ($2n = 28$) and different F_1 hybrids between them show the hybrids to be identical to *H. mollis* in floral characters. Intermediacy in other characters may assist recognition of certain hybrids in the field.

1376 *Pennant S.227—a new variety of winter oats. (p. 69).*

Developed from S172 x S147, this is an early, stem-eelworm-resistant variety superior to S147 in yield and standing ability with shorter, stiffer straw. In winter hardiness, tillering capacity and panicle characteristics it resembles its sister variety Powys, while in size, plumpness and milling quality of the grain it resembles S147.

1377 *Manod S.235—a new variety of spring oats. (p. 70).*

Manod S235 is highly resistant to stem eelworm, mildew and crown rust. It equals Sun II in yield under relatively disease-free conditions, is slightly earlier in ripening and has better standing ability. It was developed from 01750/11 x Tama.

1378 *Cooper, J. P. & Edwards, K. J. R. Selection for leaf area in ryegrass.* (*pp. 71–75*).

The genetic control of leaf size and rate of leaf appearance (as measured by the time between the appearance of the 4th and 7th leaves on the main shoot) was studied in seedlings of Irish and Hunsballe perennial ryegrass and in Italian ryegrass and heritability estimates were made. Results suggest that selection should be immediately effective for leaf length, width, area and rate of appearance in Italian ryegrass, for leaf width and rate of appearance in Hunsballe and for rate of leaf appearance only in Irish ryegrass. Selection for rapid leaf appearance, however, has invariably resulted in smaller leaves, and for leaf area, where effective, in less rapid leaf appearance.

1379 *Hayes, J. D. Investigations on the effect of DDT on barley.* (*pp. 76–80*).

Over 200 varieties grown in Europe and America have been classified on the basis of their reaction to spraying with DDT. Reaction is monogenically controlled with susceptibility to damage dominant [cf. XXIX, 2654], and crosses involving 6 genetic stocks have now been made to identify the linkage group to which this gene is attached, and to establish its relation to other genetic markers.

1380 *Evans, A. M. Relationship between vegetative and sexual compatibility in* Trifolium. (*pp. 81–87*).

Studies on interspecific compatibility using *T. hybridum* and *T. ambiguum*, and on intraspecific compatibility using *T. pratense*, revealed a parallel between sexual and vegetative compatibilities. Graft compatibility may therefore be used to screen parent plants most likely to be sexually compatible, and to indicate relationships between species.

Vorträge für Pflanzenzüchter. (**Lectures for plant breeders**).
DLG-Pflanzenzuchtabteilung Frankfurt/Main 1958 : No. 1 : Pp. 107; 1958 : No. 2 : Pp. 97; 1958 : No. 3 : Pp. 137; 1959 : No. 4 : 67–86. (Mimeographed).

These lectures were presented during 1959 at courses and meetings for plant breeders held at Göttingen and Eutin, Germany, in 1958.

Volume 1.

1381 *Kuckuck, H. Die Bedeutung von Chromosomentranslokationen für die praktische Züchtung.* (*The importance of chromosome translocations in practical breeding*). (*pp. 3–17*).

The use of translocations in breeding is exemplified by reference to a sex-linked translocation in the silkworm and Sears' work on the transference of rust resistance from *Aegilops* to wheat.

1382 *Wöhrmann, K. Der heutige Stand der Polyploidiezüchtung bei Futterpflanzen.* (*The present position of polyploidy breeding in fodder crops*). (*pp. 18–27*).

Increases in yield obtained by means of polyploidization in red clover, Italian ryegrass, serradella and turnip in various European countries are referred to and the possibilities of improving the winter hardiness and fertility of polyploids discussed. Changes in ecological requirements are also mentioned.

1383 *Frandsen, K. J. Methoden der Futterpflanzenzüchtung, insbesondere Polycross.* (*Methods of fodder-plant breeding, in particular the polycross method*). (*pp. 28–43*).

The meaning of specific and general combining ability is discussed in relation to the variability and heritability of quantitative characters, reference being made to the work of Burton on genetic variance components [cf. XXIX, 175]. The principles of diallel crossing are then outlined and the polycross method is compared with the top-cross method and reciprocal recurrent selection.

1384 *Neddenriep. Methoden der vegetativen Vermehrung bei kleeartigen Futterpflanzen.* (*Methods of vegetative propagation in cloverlike fodder plants*). (*pp. 44–51*).

In work on lucerne, red clover and Alsike clover, the best results have been obtained by: (*a*) using the upper shoots of plants which have not yet come into flower as cuttings, the cut being made directly under a node; (*b*) using washed river sand of grain size 0·5–1·5 mm. as a propagation medium; and (*c*), raising and lowering the water level of the substratum every hour, so that the cuttings are alternately watered and aerated. Preliminary short-day treatment of the parent plants was unnecessary.

1385 *Kobabe, G. Die Verwendung von männlich sterilen Mutanten in der gartenbaulichen Pflanzenzüchtung. (The utilization of male-sterile mutants in horticultural plant breeding). (pp. 52–73).*

Types of male sterility found in onion, tomato, *Brassica*, Lima bean, cucurbits, carrot and some ornamental plants are described, and their use in the production of hybrid seed is outlined with special reference to onion and tomato.

1386 *Knapp, E. Zuchtmethoden bei zweijährigen Fremdbefruchtern. (Breeding methods in biennial cross-pollinating plants). (pp. 82–107).*

In this general outline, concerned only with obligate cross pollinators with hermaphrodite flowers, the following topics are surveyed: mass selection, the use of progeny tests, controlled pollination, the drawbacks of inbreeding, its uses in developing hybrids, testing for combining ability, methods of improving inbred lines and, finally, the use and development of polyploids.

Volume 2.

1387 *Fischer, W. Einige Anforderungen der Praxis an die Futterpflanzenzüchtung. (Some demands made by agricultural practice with respect to fodder plant breeding). (pp. 19–28).*

In *Poa pratensis* and *Festuca pratensis*, improved ability to become established and compete are required. In perennial ryegrass, cocksfoot and *F. pratensis*, less leafiness is desired since there is a negative correlation between leaf number and 1000-grain weight and a positive correlation between 1000-grain weight and germination. For modern methods of harvesting, in which threshing is carried out with a combine harvester after the grass has lain in swathes for a time, the requirements are: stiffer straw, allowing the swathes to lie high on the stubble; resistance to shedding; greater uniformity of ripening; and a definite period of dormancy.

Dormancy is needed also in legumes intended for seed production. In serradella, uniformity of ripening and resistance to shedding are also desirable and in this species and red and white clover, greater tolerance of shading when sown as an undercrop is needed.

1388 *Banga, O. Gemüsezuchtprobleme in den Niederlanden. (Vegetable-breeding problems in the Netherlands). (pp. 29–36).*

The history of breeding for useful qualities is exemplified by reference to carrots, and work on onion is given as an example of the method of breeding F_1 hybrids by means of recurrent selection and the use of male sterility.

1389 *Schmidt, W. Die Frühdiagnose in der Züchtung. (Early diagnosis in breeding). (pp. 37–56).*

Examples of diagnosis of characters at an early stage include the following: testing for dry-matter content as an indication of frost hardiness in conifers; determination of growth rate in poplar and pine hybrids; estimation of branchiness in pine; determination of sensitivity to unilateral illumination in pine; and, in tomato, the detection of complementary factors which in combination tend to heterosis.

In the discussion, the desirability of conducting several diagnostic tests and also of establishing definite correlations between the results of early tests and field results was emphasized.

1390 *Sengbusch, R. von. Methodisches zur Roggenzüchtung. (Methodology in rye breeding). (pp. 57–65).*

The advantages and drawbacks of different methods used in rye breeding are outlined. It is noted that diploid gigas forms, equalling tetraploids in leaf width and stem thickness and surpassing them in fertility, but no higher than ordinary diploids in 1000-grain weight, have been found and fixed at Hamburg-Volksdorf, Germany.

1391 *Lamberts, H. Hat die Züchtung der Gelblupinen in Nordwest-Europa noch einen Zweck? (Has the breeding of yellow lupins in north-western Europe any further purpose?) (pp. 66–77).*

Breeding achievements include high yields of green matter, rapid spring growth, soft-coated seeds and resistance to mildew, wilt and frost. The difficulties of combining high fodder yields with good seed production are not considered insurmountable, but it is suggested that, given the necessary international cooperation in western Europe, it would be better to produce fodder and seed in the respective regions most suitable to each.

1392 *Bode, O. Die Virustypen bei Kartoffeln. (Virus types in potatoes). (pp. 78–87).*

The occurrence of different strains of leaf-roll, X and Y viruses and some difficulties of distinguishing strains are discussed.

Volume 3.

1393 *Scheibe, A. Die Anwendung von Chemikalien in der Mutationszüchtung. (The application of chemicals in mutation breeding). (pp. 1–12).*

Methods of applying chemical mutagens are surveyed, Oehlkers' method as used on *Melilotus albus* [cf. XXVIII, 4348] and wheat and barley [cf. 121] being described in some detail together with the results obtained.

1394 *Wienhues, F. Züchterische Voraussetzungen der Ertragsstruktur.* (*The breeding basis of yield structure*). (*pp. 62–104*).

In tests conducted in Austria, German barley and wheat varieties often outyielded Austrian. Varieties differed in reaction to locality, year and fertilizer treatment with respect to both 1000-grain weight and yield, intervarietal differences being greater among wheats than among barleys. Of two spring barleys tested for yield, 8066 was better in north-western Germany and worse in south Germany than Haisa II; yield analysis showed that although 8066 produced less dense stands, in the north-west this was compensated for by a higher number of grains/ear. Similarly the variety 8282 outyielded other lines in bad years by virtue of its large grains compensating for its poor tillering under these conditions. It is thought that wide adaptation, allowing good yields to be produced under varied conditions, would be promoted by favourable genotypes for all three yield components: grains/ear, number of tillers and 1000-grain weight. Intervarietal differences in combining ability for the yield components were detected in crosses involving three breeding lines and three varieties of wheat. Line 8835 gave progeny combining high 1000-grain weight with a favourable distribution of the two other components. An analysis of the F_2 of 8835 x Hauter II showed transgressive segregation for all three components in some families which was apparent even in bad years. Inheritance of high grain number per ear seemed to be most favourable in this cross.

In barley crosses hybrids showing transgressive segregation and giving consistently high yields were obtained fairly easily, but only at one locality.

In wheat, back crossing to the parents has also proved valuable in the production of transgressive types and may be useful in improving the yields of existing varieties.

1395 *Loerke, E. Die Züchtung der Gemüseerbse in der Vergangenheit mit Buchausstellung.* (*The breeding of vegetable peas in the past, together with an exhibition of books*). (*pp. 105–37*).

A history of the development of different types of peas during the past few centuries is presented, and a list of the books exhibited after the lecture is appended.

Volume 4.

1396 *Brouwer, W. Pflanzenbau und Pflanzenzüchtung.* (*Crop production and plant breeding*). (*pp. 67–86*).

General observations on environmental factors affecting yield and on breeding for resistance to pests and diseases, tolerance of climatic factors and quality are presented.

1397 SCHICK, R.
Bedeutung und Aufgaben der Pflanzenzüchtung bei der sozialistischen Umgestaltung der Landwirtschaft. (**The importance and problems of plant breeding in the socialistic transformation of agriculture**).
Wiss. Z. Univ. Rostock : Math.-Naturwiss. Reihe 1959/60 : 9 : 9–12.

In this general lecture, breeding aims for crops grown in eastern Germany are considered.

Bericht über die Arbeitstagung 1958 der "Arbeitsgemeinschaft der Saatzuchtleiter" im Rahmen der "Vereinigung österreichischer Saatgutzüchter." (**A report on the 1958 meeting of the working party of the principal seed producers within the framework of the Association of Austrian Seed Producers**).
Gumpenstein 1958 : Pp. vi + 110. (Mimeographed).

1398 *Mainx, F. Die Physiologie der Genwirkung.* (*Physiology of gene action*). (*pp. 3–6*).

A brief review is given of some of the available knowledge of gene action in various organisms.

1399 *Hänsel, H. Die Phenolreaktion und ihre Vererbung bei Gerste.* (*The phenol reaction and its inheritance in barley*). (*pp. 7–16*).

The results of testing the phenol reaction of the grain of a collection of varieties are reported. The F_2 of crosses between a variety which colours darkly in the presence of phenol and strains of Vollkorn [Round Grain] which remain light in colour segregated in the ratio of 3 dark : 1 light.

1400 *Lasser, E. Erfahrungen bei der Kombinationszüchtung von Winter- und Sommergersten.* (*Experiences in the combination breeding of winter and spring barleys*). (*pp. 17–25*).

The improvement of winter hardiness, standing capacity, disease resistance and other important characters is discussed in relation to the author's own hybridization experiments in Austria.

1401 *Neururer, H. Phytopathologische Probleme im Getreidebau.* (*Phytopathological problems in cereal cultivation*). (*pp. 35–41*).

Mention is made of important cereal diseases in Austria and the work being carried out on the differentiation of races of pathogens and the testing of resistance in the host plants.

1402 *Sedlmayr, K. Physiologisch-genetische Probleme der Zuckerrübenzüchtung.* (*Physiological and genetical problems of sugar-beet breeding*). (*pp. 42–56*).

In this survey an attempt is made to show how recent research on the physiology of flowering, fertilization and development, polyploidy, resistance to disease and interspecific hybridization has enabled progress to be made in improving sugar beet; questions requiring further study are mentioned.

1403 *Steineck, O. Neue Selektionsverfahren in der Kartoffelzüchtung.* (*New selection procedures in potato breeding*). (*pp. 57–71*).

The determination of the photoperiodic requirements of seedlings by observing stolon development under different photoperiodic conditions is described [cf. XXIX, 502]. Mention is made of a large-scale experiment in which many seedlings adapted to the photoperiodic conditions in Austria were selected. It was found that reaction to photoperiod is most marked during the longest days of summer. The varieties Saskia and Sirtema have proved good parent varieties with respect to photoperiodic requirement but not Bintje and Maritta.

When Toni, a variety with a low critical day length, was grafted on to Urgenta, with a higher photoperiodic requirement, the tuber production was reduced to 58·9% as compared with 100% for Urgenta/Urgenta. In the combination Urgenta/Toni, the yield was about 50% higher than that of Toni/Toni. These results indicate that tuber development is controlled by a growth substance. One-year-old seedlings treated with 2,4-dichlorophenoxyacetic acid reacted under short-day conditions in a similar way to untreated seedlings under long-day conditions. Treatment with growth substances may therefore be of use in selecting for photoperiodic requirement.

Selection for tuber number in young seedlings is discussed. It is pointed out that tuber number is related to stem number and a two-year-old seedling with an ideal number of tubers may yield too many in the following year when it produces more stems. The importance of selecting for a suitable and constant tuber size is stressed; the selection can take place when the seedlings are three years old.

The analysis of selfed progenies is discussed.

1404 PRIEZŽEV, G. V.
(The oldest breeding and genetics station).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 41–43. [Russian].

Breeding of crop plants, including wheat, buckwheat, oats, barley, lucerne, red clover, potato, flax and pea, at the Timirjazev Agricultural Academy since its foundation in 1904 is surveyed. Photoperiodism, training cereals for spring or winter habit, vegetative hybridization and selective fertilization are among the methods that have been used. Conversion of *Triticum turgidum* into soft wheat has been accomplished by subjecting germinating grains to temperatures of 0°C.–5° C. for 160–180 days. The progeny gave rise to soft winter and spring wheats and also to *T. durum* and *T. turgidum* plants. Most of the varieties of crop plants bred at the institute have been mentioned in various previous reports, while others, notably some buckwheats and lucernes, have not yet reached the advanced trial stage.

1405 MARINICI [MARINIČ], P. E.
Noua raionare a soiurilor de plante agricole în U.R.S.S. (**Recent varietal standardization of agricultural plants in the USSR**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 3 : 88–98.

[Cf. XXX, 162].

1406 Årsberättelse över Sveriges Utsädesförenings verksamhet år 1959. (**Annual report on work of the Swedish Seed Association in the year 1959).**
Sverig. Utsädesfören Tidskr. 1960 : **70** : 133–232.

Breeding has proceeded along the same lines as in previous years [cf. XXX, 1152]. In addition to the information summarized below, the report contains data on the performance of numerous promising lines and hybrids under study at Svalöf and the branch stations. Crops in which breeding is in progress include oats, rye, barley, grasses, lucerne, clovers, beet, turnip, potato, flax, cruciferous oil plants, beans and pea.

With the aim of increasing the genetic variation of tetraploid breeding material, chromosome doubling has been effected in a wide range of diploids of clover, rye, turnip, beet and various grasses.

Below a certain percentage, differing for each species, the amount of diploid seed in tetraploid material does not increase in successive generations of open pollination; for tetraploid rye the threshold value is about 40% while for tetraploid clovers it is 2–4%.

Wheat. At Ultuna, lines from Odin x 01251 and Odin x Eroica have been relatively little attacked by *Fusarium nivale* (*Calonectria nivalis*). At Örebro station, three lines from Norröna x Kärn II [Kernel II] have outyielded Norröna while equalling it in earliness.

Barley. The X-ray mutant *erectoides* 32 has been released under the name Pallas [cf. XXIX, 3526]; it has given promising offspring in crosses with Herta and has also been subjected to further radiation. The very early variety Sv04080 has done well at several stations.

At the Västernorrland branch station, stiff-strawed, early material from Herta x Å38/230 has shown good tolerance of aphid attack and has outyielded Herta by 20–40%.

Ethyl methane sulphonate is able to induce a mutation frequency in barley five times greater than that obtainable by X irradiation, and causes little or no chromosome fragmentation or translocation.

Grasses. By means of X irradiation, the apomictic mechanism has been broken down in *Poa pratensis*, enabling crosses to be made and new morphological types to arise; the apomictic condition can be restored in subsequent generations.

Clover. The tetraploid red clover Sv059, derived from the crosses Merkur x Wambåsa, Merkur x Øtofte and Merkur x Offer, has shown very good resistance to *Sclerotinia* and has yielded 120% more than Hermes.

Mangel. Work on the production of commercial varieties from crosses of diploid and triploid material is in progress and further crossing between monogerm mangels and common varieties is under way.

Turnip. Several new tetraploids have been developed, including two kinds of large-leaved turnip and one population with a very high dry-matter content.

1407 Verslag landbouwkundig onderzoek in Nederland, 1959. (**Report on agricultural research in the Netherlands in 1959**) : Pp. 185.

Male sterility. At the Plant Breeding Foundation, moderate to high levels of male sterility have been induced in red and white clover and beets by means of 2,3-dichlorobutyrate; in beet, little or no effect upon female fertility has been observed.

Wheat. The spring wheat selection 5014/5 has shown promise in respect of baking quality in tests at the Plant Breeding Foundation. Similarities observed between the withering and dwarfing forms of semilethality studied at the Agricultural Crop Breeding Institute [cf. XXX, 2324] include complementary gene action, the occurrence of qualitatively similar but quantitatively different forms of the semilethal genes and the influence of modifying genes and environment upon inheritance. Two red-grained selections made at the Central Bureau, the one winter hardy and the other very winter hardy, have given high yields in the official trials. Evidence of the occurrence of two new subraces of yellow rust, distinguishable by the reaction they evoke in adult plants, has been obtained at the Institute of Research in Plant Pathology.

Maize. In studies of recurrent selection at the Agricultural Crop Breeding Institute, significant differences in combining ability have been found between population fractions subjected to selection in opposite directions.

Grasses. An amphidiploid has been obtained at the Plant Breeding Foundation from 4*n* perennial ryegrass x 4*n* *Festuca pratensis*. Crosses between 2*n* perennial ryegrass and 6*n* *F. arundinacea* have yielded about 50 highly drought-resistant hybrids.

Beet. At the Plant Breeding Foundation, yellows-tolerant sugar beets have been developed from repeated crosses between tolerant inbred lines and from other material. Tetraploid and triploid mangels derived from tolerant diploids appear to have retained their tolerance. Hybrids between *Beta vulgaris* and *B. webbiana* had characteristics of both parents and showed normal fertility. Male-sterile individuals have been found among F_2 populations of mangel crosses. At the Institute for Rational Sugar Production, hybrids tolerant of *Heterodera schachtii* have been selected from crosses of *B. maritima* and sugar beet. Heritable differences in susceptibility to *Ditylenchus dipsaci* have been detected in mangels.

Turnip. At the Plant Breeding Foundation, many of the F_1 hybrids from crosses between inbred lines have proved productive, often giving higher yields than commercial varieties.

Resistance to a new race of club root has been found in this material.

Potato. At the Plant Breeding Foundation, the diploid *Solanum goniocalyx* is proving a useful source of quality factors in crosses with Netherlands varieties. The resistance of *S. stoloniferum* and its derivatives to all races of virus Y, including a new race, appears to be inherited simply. In tests at the Agricultural Crop Breeding Institute, *S. bulbocastanum*, *S. polytrichon* and *S. semidemissum* have shown promise as sources of blight resistance. Good resistance to leaf-roll virus is present in material at the Central Bureau, and several strains immune from virus Y have been found. A seedling with good baking and chip-making quality has shown promise in trials.

Flax. Three new varieties which appear to be completely resistant to rust even in the seedling stage are being investigated at the Institute of Research in Plant Pathology.

Black currant. At the Agricultural College, two tetraploids and three triploids have been developed by means of colchicine treatment.

Forest trees. Material from *Populus alba* x *P. grandidentata* combines outstanding growth with resistance to drought and diseases.

Work on *Ceratocystis ulmi* at the Willie Commelin Scholten Laboratory has shown that the fungus can grow in the wood of both susceptible and resistant elms, but that it remains localized in the latter and spreads tangentially in the former. No relation between histological differences and differences in resistance could be detected, nor was there any relation between the pathogenicity of a strain and the toxicity of the culture filtrate obtained from it. A method of testing very young seedlings for resistance has been devised.

Brussels sprouts. Studies of the inheritance of the annual and biennial characters have shown that the former is dominant and monogenically determined [cf. XXX, 167].

Spinach. Observations at the Horticultural Plant Breeding Institute indicate that the leaf production and seed yield of a given variety are closely dependent upon its critical day length.

Tomato. From crosses of Ailsa Craig and Abunda with Canadian varieties resistant to *Cladosporium fulvum*, lines resistant both to *C. fulvum* and *Nicotiana* virus 1 have been selected at the Horticultural Plant Breeding Institute.

Phaseolus. Biochemical and genetical studies of seed and plant colour have been made [cf. 1058].

1408 Rudolf, P.
(Creative enrichment of materialist biology).
Agrobiologija (Agrobiology) 1959 : No. 5: 752–53. [Russian].

Reference is made to Lamarck, Darwin, Haeckel and other early biologists, and to Mičurin. Among new varieties produced by Mičurin's methods in Rumania are: the apple 1138, combining resistance to diseases with high quality of fruit; the large-fruited pear 129/2; hybrids between sweet and sour cherry, including the self-fertile hybrid 1183; and intergeneric hybrids of tomato with the pollen parents *Capsicum annuum* and *Physalis alkekengi* which are superior to the mother variety in hardiness, productiveness and fruit quality.

1409 **Director's Annual Reports of the Indian Agricultural Program.**
Rockefeller Found., NY : September 15, 1957 – July 31, 1958 : Pp. 62; August, 1958 – July, 1959 : Pp. 54.

Information is given on aims and progress of the cooperative programme between the Rockefeller Foundation and Indian Agricultural Research Institute and other institutions in India. The activities include the improvement of maize and sorghum and other millets by breeding. Emphasis is being laid on the utilization of a wide range of Indian and foreign germ plasm. Considerable importance is also attached to the exploitation of hybrid vigour, not only in maize, but also in sorghum through the use of cytoplasmic ♂ sterility.

1410 **Annual Report of the Indian Council of Agricultural Research for 1955–56** : Pp. 196; **1956-57** : Pp. 209.

The reports include information on the main features of breeding carried out on the following crops in different parts of India as part of the activities of the council: wheat, hybrid maize, barley, F_1-hybrid *Pennisetum typhoides*, sorghum, rice, sweet potato, tapioca, *Piper*, chilli, *Annona*, guava, mango, papaya, banana, grape and vegetables such as tomato, okra and pulses.

1411 **Agricultural Research in Uttar Pradesh (1950-56).**
1957 : **2** : Pp. 197.

The publication offers a survey of work on crop improvement during the period of the first five-year plan in Uttar Pradesh, including introduction, testing and breeding carried out with cereals, millets, potato, fibre crops, sugar cane, tobacco, oil seeds, pulses and vegetables.

1412 **Scientific Reports of the Indian Agricultural Research Institute for the year ending 30th June, 1957** (1958) : Pp. 136.

Induced mutations. Mutations were induced in wheat, potato, cotton and tobacco by exposing seeds or seedlings to X rays, β radiation from P^{32} and S^{35}, ultraviolet rays, fast and thermal neutrons and chemicals. Among the promising mutants were: awned plants, less susceptible to bird damage, in four improved but awnless wheat varieties; early ripening plants in the wheat NP809, which might ultimately make it possible to introduce this rust-resistant variety in the plains; mutants of the potato Up-to-Date bearing tubers lacking a dormancy period and able to grow under conditions of high air temperature; ♂-sterile mutants of Upland cotton which may facilitate hybrid-seed production; and broad-leaved plants of the tobacco Nattu.

Treatment of *Colletotrichum falcatum* (*Physalospora tucumanensis*) with P^{32} or fast neutrons resulted in three mutants, respectively altered in spore dimensions, biochemical requirements and spore colour. Two of the mutants were slightly more virulent than the parent in the sugar-cane variety Co. 647. Mutants of *Phycomyces blakesleeanus* were also induced by P^{32} treatment.

Wheat. In breeding bread wheat for the plains at Delhi, advanced selections highly resistant to one, two or all three of the rusts *Puccinia graminis* var. *tritici*, *P. triticina* and *P. glumarum* and with good agronomic characters have been developed from crosses of introduced resistant parents with improved Indian wheats. Promising rust-resistant selections have been secured from crosses of *T. durum* 'Gaza' with the common wheats NP710, NP718, C281 and C591. Progress has also been made at Simla in breeding rust-resistant bread wheats for the hills. Further work was carried out on improvement of *T. durum* at Indore and of *T. dicoccum* at Wellington. Selected from local *T. dicoccum* and ready for release, PD13 has a high degree of field resistance to yellow and leaf rusts. Progress was made in breeding for loose-smut resistance at Delhi. The search for bunt resistance at Simla and for resistance to *Neovossia indica* at Karnal yielded promising material. Assessment of the chapati-making qualities of Indian wheats was initiated. The new rust and loose-smut resistant wheats NP797, NP798 and NP799 again gave a superior performance in yield trials. The development of varieties responding to different levels of soil fertility is receiving attention. The genetics of seedling and adult-plant resistance to stem and yellow rusts and other characters such as awning, grain colour, and auricle and glume pubescence was studied in common wheat by ordinary hybrid analysis. In monosomic analysis, F_2 data from crosses of Chinese monosomics x Cometa Klein confirmed the presence of genes for awning in chromosomes III, VIII and X. Segregations for resistance at the seedling stage to race H of yellow rust suggested that genes for yellow-rust resistance may be situated in chromosomes IV and VI of Cometa Klein. Genes for several morphological characters were also assigned by monosomic analysis to specific chromosomes in E220, NP790 and E952.

Maize. Some of the inbreds under study have been found to possess high general and specific combining ability. Double-cross seed of foreign hybrids, produced from acclimatized inbreds, gave much higher yields than Indian open-pollinated varieties. A Texas source of cytoplasmic ♂ sterility is being used to incorporate this character in inbreds of Indian flint.

Barley. Hybridization to develop varieties resistant to rusts is under way. Yellow-rust susceptibility was dominant and monogenic in the crosses studied. Virescence of seedlings behaved as a simple recessive to normal green. The hooded condition was monofactorial and dominant. A one-gene difference was detected between the two and six-rowed condition, with two-rowed ears dominant. Row number was independent of the hooded *v.* awned condition.

Sorghum. Over 250 cultures were studied for their genetic variability in agronomic characters. Indigenous types were crossed with ♂ sterile Texas Blackhull Kafir as an initial step in the production of F_1 hybrid seed.

Pennisetum typhoides. Investigations on the exploitation of hybrid vigour continued.

Trifolium. Tetraploids of *T. alexandrinum* gave a yield of green fodder per cutting three to four times that of the diploids.

Cotton. Selection of *Gossypium hirsutum* has resulted in material especially promising in staple length (29·0–33·2 mm.) and ginning outturn (27·0–38·2%). In a hybrid-vigour trial, F_1s of H14 x AC91 and H14 x AC89 outyielded the standard H14 by 25%, without deterioration in staple length or ginning percentage.

Essential-oil plants. Selections of *Trachyspermum ammi*, coriander, cumin, dill and fennel are under study.

Oilseeds. Comparison of newly produced tetraploids of toria with the C_{16} showed that multivalent frequency was significantly reduced in the established tetraploids, normal bivalent formation and complete fertility being obtained. Progress in breeding early-maturing, rust-resistant strains of linseed continued. "Cyclic" crosses were made among tetraploid selections in the hope of securing a higher degree of fertility at the 4*x* level.

Tobacco. Treatment with radioisotopes stimulated pollen-tube growth; this effect was successfully utilized to overcome interspecific incompatibility in *Nicotiana*.

Grape. Induction of polyploidy in several varieties by colchicine treatment received attention.

Pomegranate. Standardized techniques for meiotic and mitotic studies were developed.

Onion. Early Grano outyielded all yellow and white hybrids produced from lines introduced from the USA.

Melons. Tetraploids of water and musk melons were produced and crosses made between the 4*x* and 2*x* forms.

Tomato. Of the F_1 hybrids tested, Sioux x Meeruti and its reciprocal gave the highest yields.

Pea. Selections were made from intervarietal crosses. Early Badger transmitted its property of well-filled pods.

Pigeon pea. Further progress was made in breeding to resistance for wilt (*Fusarium udum*).

Other vegetables. Selection of self-incompatible and cross-compatible lines in various cruciferous vegetables continued with a view to hybrid-seed production. To improve the quality of Asiatic varieties of carrot, turnip and radish, and also to obtain more variability, crosses were made with temperate varieties.

Algae. Study of genetic variability in Indian algae has been initiated with a view to exploring the possibility of their use as sources of food or as nitrogen fixers.

1413 Administration Report of the Agricultural Department, Kerala, for the year 1957-58 (1959) : Pp. 109.

Rice. The results of a number of varietal trials are reported. A number of selections from *japonica* x *indica* crosses have been carried forward for progeny-row trials. A programme to select varieties resistant to blast has been undertaken at the Ambalavayal Research Station; the pathogens causing disease were identified as *Nigrospora* spp. and *Helminthosporium* spp. At the Pattambi station hybridization work is reported on the following projects: to evolve a nonlodging type of Ptb.2; to produce a Ptb.10 strain possessing dormancy; to induce resistance to *Helminthosporium* in Ptb.31; to breed a Co. 3 strain which will not lose viability in storage; and to evolve drought-resistant, high-yielding strains suitable for the Malabar uplands.

Coconut. A new hybrid variety has been released; it was bred by crossing selected tall females with dwarf males. The progenies of high-yielding parents are under study. It has been observed that large nut and high set are best transmitted to the progeny when the particular character is possessed by the female parent. In the case of high female-flower production, the progenies were superior when the male parent possessed the character. A number of intervarietal crosses have been carried out with a view to determining optimum parental combinations.

Pepper. Details are given of a number of promising hybrids bred at the Pepper Research Station, Panniyur. Selection for resistance to wilt and to spike shedding has continued.

1414 Administration Report of the Director of Agriculture for 1959. Part IV—education, science and art (C).

Dep. Agric. Ceylon 1960 : Pp. 207.

Rice. Hybrids H–4 and H–5, both developed from Murungakayan 302 x Mas, continue to perform well and show adaptability to a wide range of soil and climatic conditions. H–4 also shows high resistance to stem borer and moderate resistance to gall fly (*Pachydiplosis oryzae*). Stem-borer resistance was also found in Pachchaiperumal 2462/11, Suduvi 306, PP x Mas, Remadja, Samba and Ratauwi. The hybridization project continued and a programme was initiated to incorporate blast resistance in the widely grown varieties Pachchaiperumal and Podiwi a–8. Promising hybrids are Panduruwi x Mas, Mas x Ptb–16 and Podiwi a–8 x Mas. Progenies from Podiwi a–8 x Mas show resistance to blast, grain shedding and lodging and resemble the Podiwi parent in grain size and quality.

Hibiscus. Strains of *H. esculentus* which appear to be resistant to mosaic are being selected.

1415 Annual Report of the Department of Agriculture, Ghana, for the year 1956-1957 (1959) : Pp. 84.

Breeding work carried out on sorghum, millet and maize, and variety trials of rice, cassava, groundnut and yam are briefly reported.

Sorghum. The segregation ratio in the F_1 of the cross Nunaba x Nelko indicates that the gene controlling glume type in Nunaba is probably recessive. A number of crosses were made with the aim of transferring the glume type of Nunaba to lines with more desirable grain characters. Selection of dwarf varieties and of various tall hybrids continued.

Rice. New crosses were made with the object of producing stiff-strawed high-yielding lines of different maturation periods.

Cassava. Of 206 seedlings from mosaic-resistant hybrids, only 12 remained free of symptoms; these are being included in palatability trials.

1416 Annual Report of the Department of Agriculture of the Northern Region of Nigeria, 1955-56 : Pp. 161.

Variety trials of groundnut, *Pennisetum*, maize, sorghum, soya bean, sunflower, sugar cane, sesame, safflower, rice, cassava, *Vigna*, tobacco and other crops are reported.

Maize. Hybrids, varieties and lines received from the West African Maize Research Unit, Ibadan, are being grown. Selected plants from four lines of Mexico 1 and two lines of Mexico 5 were selfed and the seed bulked within lines. The F_1 material of a standard US hybrid with Mexico 1 was selfed.

Sorghum. A pale-grained Kaura selection was grown at Samaru and the best plants will be further selected. Crosses of USA varieties with local forms are reported; lines with a white seed coat and yellow endosperm resulted from crosses with Kaura.

Cotton. Yield trials of progenies derived from 26C/479–25 revealed significant differences within this material [cf. XXVIII, 3180].

Sugar cane. Testing for resistance to *Colletotrichum falcatum* continued; resistant varieties are being multiplied.

Groundnut. A collection of groundnuts obtained from different countries and comprising not only the tetraploid *Arachis hypogaea* but also the diploid species *A. pusilla* and *A. villosa* has been distributed among various stations for testing. Rosette-resistant selections from the East African variety Mwitunde were grown, and high-yielding lines were bulked for further trials. In the F_3 of the cross M'Foko x American White, a white-kernelled selection of the Castle Cary type appeared. Observations on the growth habit of progenies from six varieties which differed in testa colour and growth habit revealed none of the off-types that would have indicated outcrossing. After shelling, however, kernels were found that differed slightly in colour from those of the original parents.

Vigna. A breeding programme designed to introduce white seed colour into the high-yielding coloured varieties Mauritius and New Era is being undertaken.

1417 Annual report of the Ministry of Agriculture of the Northern Region of Nigeria 1957-58 : Pp. 64.

Variety trials of maize, sorghum, rice, pasture grasses, sweet potato, cotton, sugar cane, cowpea, cassava, yam, sesame, groundnut and soya bean are reported.

Maize. Breeding of early-maturing varieties suitable for more northerly districts was continued.

Sorghum. In trials of indigenous varieties, Farafara, Yar Gunki and Kaura have performed well over wide areas. An improvement programme for these varieties is in progress.

Rice. Swamp-rice improvement was continued and varieties suitable for shallow and controlled water conditions are being distributed. A search for an *Oryza sativa* variety to replace the *O. glaberrima* varieties grown in deep and uncontrolled water conditions is in progress.

Cotton. In trials of progenies from Samaru 26C and its relatives, lines combining high yield with good ginning percentages and adequate lint length were found; the best-yielding progenies were far in advance of the 26J stock used as a standard in these trials.

Groundnut. From the results of 23 variety trials, recommendations are made for various districts.

1418 Annual report of the Department of Agricultural Research, Federation of Nigeria, for the year 1958-59 (1960) : Pp. 43. (Mimeographed).

Rice. Trials of varieties and selections for suitability to various conditions were carried out. Further attempts were made to cross *O. glaberrima* with *O. sativa* varieties using the former as pollen parent, and 194 grains were obtained. The inheritance of sensitivity to photoperiod is being studied in crosses of non-sensitive with sensitive *indica* varieties.

Sweet potato. The results of 509 self pollinations and 348 cross and reciprocal pollinations of a number of parent varieties and progeny lines indicate complete self incompatibility in all varieties and cross incompatibility between certain varieties.

Cassava. The collection and classification of Nigerian cassava varieties continued. High-yielding lines selected from interspecific hybrids produced in 1957 [XXX, 187] have been selfed, crossed with high and low-yielding varieties and intercrossed to determine the segregation of high-yielding individuals in the progenies. Segregation studies on mosaic-resistant lines are also in progress. Further *Manihot utilissima* x *M. glaziovii* and *M. utilissima* x *M. utilissima* crosses were made. The inheritance of the high protein content of *M. melanobasis* tubers is being investigated in crosses of this species with *M. utilissima*. Six varieties were crossed in all possible combinations, and 53101 and its progenies found to be the highest yielding; variety 42074 and its progenies showed most resistance to mosaic. Variety 58308 from *M. glaziovii* x *M. utilissima* has remained free from mosaic symptoms after three years' exposure to infection in the field.

Yam. Trials of varieties of *Dioscorea rotundata*, *D. alata* and *D. cayenensis* were carried out, and significant varietal differences in germination percentages were found within species. In mean dry-matter content, *D. cayenensis* was highest, followed by *D. rotundata* and *D. alata*.

Cola. Studies on the inheritance of nut and cotyledon colour in *C. nitida* continued. The F_1 plants from self or cross pollinated pink-nut trees bred true for pink cotyledon. Self incompatibility was studied in red-nut trees from crosses of red x white, red x pink and red x red parents, and was found to be greatest in trees from pink x red parents. Self-incompatible trees which were cross pollinated bred true for red cotyledon colour.

1419 Rapport Annuel pour l'exercice 1959. (**Annual Report for the financial year 1959**).
Publ. Inst. nat. agron. Congo belge 1960 : Pp. 604 + Pp. xii.

In addition to the results summarized below, breeding of cereals, forage grasses, potato, sweet potato, yam, tea, tobacco, *Pyrethrum*, fruits and other minor crops is briefly reported. The results of a large number of varietal trials conducted at branch stations throughout the Congo are also outlined.

Rice. A number of hybridizations have been carried out to improve resistance to lodging in R20, RE352 and OS6, and to increase vitreousness in R20 and RE352; these five lines were crossed with RE248 and RE342, varieties possessing the desired characteristics. Techniques for producing polyploids in R20 x Iguape Cateto and R20 x Rexark hybrids are described. Complete sterility was observed in *Oryza sativa* x *O. glaberrima* hybrids and was attributed partly to serious abnormalities in the pollen.

Cotton. At the Gandajika station, several lines originating from crosses of 1103 x GAR have shown promise, particularly NC8/2673, which is characterized by superior fibre length and notable adaptability, disease resistance and yielding capacity. A number of other trials carried out at this station are reported.

A number of tetraploid x diploid crosses were effected. Upland x *Gossypium arboreum* hybrids did not survive, but one *G. arboreum* x Upland and one Upland x *G. herbaceum* hybrid grew successfully. Observations are reported on the resistance of a number of *Gossypium* species and certain hybrids to psyllosis (*Paurocephala gossypii*), *Lygus vosseleri* and *Empoasca fascialis*. At the Lubarika station, GAR x Tangüis, BP x 14.124 and C2 x 1021 hybrids performed well.

Coffee. It was observed that crosses between Robusta and the hybrid Kawisari D are most successful when the latter is the maternal parent. Other studies showed that Kawisari D is partially self fertile while tetraploid Robusta is completely self sterile. Seasonal variations were found to influence the success of artificial fertilization in the interspecific crossing programme. The diploid chromosome number of *Coffea liberica* was found to be 22 and that of *C. arabica* mutant *bullata*, 88.

Cacao. In a 6-season trial, Forastero clones outyielded Eala, Likimi and Mobwasa hybrid clones. Based on this trial some general observations are made as follows; the performance of a productive clone is consistent irrespective of whether orthotropic or plagiotropic cuttings are used; there is no relationship between the productivity of a clone and that of its illegitimate progeny; as far as yields are concerned, the plagiotropic cutting method is superior to other techniques; there appears to exist a variable relationship between productivity, origin and the method of multiplication used.

Oil palm. Observations continued on a large number of lines produced by selfing or hybridization; data are provided on the performance of some of these lines. It was confirmed that the *virescens* character is controlled by a single incompletely dominant gene; its effects are influenced by modifying *nigrescens* alleles.

Rubber. Tabulated information is presented on the performance of both legitimate and illegitimate progenies as well as some vegetatively-produced clones.

Groundnut. Two improved lines have been selected and have outyielded the control A65 in trials at Yangambi.

Banana. The diploid chromosome numbers of a large range of hybrids are reported as well as of the following; *Musa acuminata* sspp. *burmanica* and *burmanicoides*, $2n = 22$; *M. acuminata* (AAA) 'Marau', $2n = 33$; and *M. sapientum* (AAB) 'Ambon', $2n = 33$.

1420 **Annual Report of the Department of Agriculture, Uganda Protectorate, for the year ended 31st December, 1958** : Pp. 75.

Maize. A Muratha strain which is resistant to *Puccinia polysora* [cf. XXX, 188] was included in trials of Muratha, K8 and new selections from these two varieties. The rust-resistant strain outyielded the old varieties but was not as good as some of the new selections. It matured substantially earlier than the other Muratha strains but later than the K8 strains.

Eleusine. A programme has been initiated to transfer to local varieties the immunity to *Piricularia oryzae* of the Mozambique variety 359.

Sorghum. Dwarf sorghum lines with grain similar to that of local varieties are being grown at Serere; they mature in 90 days compared with the 110 days required by local tall sorghums. Bulked seed of six of these lines is being tested at various centres in the eastern province, selections being made locally for food and brewing purposes. Three sweet-grained selections which can be grown free from bird damage during the rainy season have been issued.

Coffee. First generation Arabica hybrids incorporating rust-resistance genes from Sudan and Abyssinia types are being grown at Kawanda. A number of Mysore and Tanganyika selections are being studied for reaction to local rust strains. The Kenya variety K7 has again performed well at all centres. Compatibility studies on Robusta types were continued. In the self-pollinated flowers examined, no pollen tube had penetrated farther than the papillary layer of the stigma. No evidence of cross incompatibility was found.

Annual Report of the East African Agriculture and Forestry Research Organization for the period 1st January to 31st December, 1958 : Pp. 109.

1421 *Doughty, L. R. Cassava breeding for resistance to mosaic and brown streak viruses.* (*pp. 48–51*).

Work over a period of 21 years in the breeding of cassava for resistance to mosaic and brown streak viruses is reviewed [cf. XXIX, 3545].

1422 *Doughty, L. R. & Gourlay, D. W. The year's work.* (*pp. 51–55*).

A number of cassava clones have shown resistance to one or both of the above virus diseases. Some are intercrosses between lines of ceara and *Manihot dichotoma* origin, while others are intercrosses of ceara and *Manihot melanobasis* derivatives. Details are given of several promising clones on trial at various regional stations.

1423 *Doughty, L. R. & Graham, T. Maize breeding.* (*pp. 55–57*).

Work on the application of the Brieger method to maize breeding has continued.

1424 *Storey, H. H. & Howland, A. K. The genetics of resistance in maize to the virus of streak disease.* (*pp. 57–58*).

Work on the genetics of resistance in maize to the streak disease virus has been facilitated by the acquisition from South Africa of a number of resistant lines with Peruvian Yellow parentage. It appears doubtful whether resistance to streak is controlled by a single gene.

1425 *Doggett, H. Sorghum breeding research scheme.* (*pp. 58–60*).

A colchicine technique for the production of sorghum polyploids is described.

Annual Report of the East African Agriculture and Forestry Research Organization for the period 1st January to 31st December, 1959 : Pp. 91.

1426 *Storey, H. H. & Howland, A. K. Genetics of resistance in maize to the virus of streak disease.* (*pp. 40–43*).

A method for testing maize resistance to the streak-disease virus is described. Selection for improved resistance has continued; resistant South African lines have been introduced into the breeding programme. It appears that genes for susceptibility are dominant and that high resistance occurs only in genotypes homozygous for recessive genes.

1427 *Doggett, H. Sorghum breeding research scheme.* (*pp. 43–46*).

Selection for large glumes, long awns and pendent heads has been carried out in sorghum, the purpose being to breed varieties unattractive to birds. Progress is reported in the development of tetraploid sorghums and in the solution of some problems associated with autotetraploids, such as the restoration of fertility.

Annual Report of the Department of Agriculture, Colony and Protectorate of Kenya for 1958. Volume II —Record of investigations. 1960 : Pp. 167.

1428 *Thorpe, H. C. Annual report of the senior plant breeder, 1958.* (*pp. 47–56*).

Wheat. Two derivatives of [(*Triticum dicoccoides* x *Aegilops speltoides*) x Austin^2] received from Texas, and the varieties Zipa and Fontaleza from Colombia and Argentina respectively are being used in breeding for stem-rust resistance. Among the derivatives of 17 crosses involving lines introduced from Colombia in 1956, II–1476 and II–3475 show promise. Two collections of material comprising 188 stem-rust resistant lines and 153 stripe-rust resistant lines were established; all of the former have been crossed with the Kenya varieties 184P, 294M, 354P, Regent and 362B1D3D, and an intensive backcrossing programme is being undertaken. Tests for suitability to high, medium and low altitudes were continued in various regions; seven recently-released wheats suitable for high altitudes are listed [cf. XXIX, 3678].

Maize. At Njoro, further selfing of Njoro synthetic I was carried out and selections are being evaluated against the new synthetic II with a view to the production of synthetic III. Syn.I x syn.II hybrids are being grown. At Kitale, trials of imported inbreds and varieties and of their crosses with Kitale synthetic I failed to reveal any lines able to outyield the synthetic. Kitale synthetic II, although not yet ready for release, shows promise. Selection for leaf-blight and rust resistance was continued. In breeding for earliness, the crosses with Taboran [cf. XXX, 189] appear most promising.

1429 *Bumpus, E. D. Annual report of the grassland research team, 1958.* (*pp. 74–91*).

Selection for an improved variety of *Setaria sphacelata* based on Nandi Setaria (a variety from the Nandi district of Kenya) is almost complete. Four generations of six distinct varieties of *Cenchrus ciliaris* were studied and no evidence of crossing was found. In similar tests with *Melinis minutiflora* varieties, one hybrid plant was found; it is suggested that this species may be a facultative apomict with a very low proportion of natural crossing. Uniformity trials of four varieties of *Chloris gayana* revealed considerable intravarietal variation in some valuable characters, including resistance to certain diseases.

1430 **Annual Report of the Department of Agriculture of Tanganyika 1958** (1959) : Pt. II : Pp. 33.

Wheat. As part of a breeding programme directed to the production of early-maturing rust-resistant wheats suitable for the Northern Province, a wide range of material is being studied; of 640 strains examined only 17 were sufficiently rust-resistant to merit further observation.

Sorghum. Selection for earliness, short straw and grain quality continued; in the backcrossing programme, line BC2MS continues to segregate.

Rice. In variety trials at Mlali, selection A/O/759 appeared most promising in yield and uniformity although in cooking quality it was inferior to local strains. At Chambezi, selections 1/194, 1/324 and 1/166 appreciably outyielded local varieties.

Cotton. The programme to incorporate the bacterial-blight resistance gene B_6 into Ukiriguru strains continued, although it is now doubted whether this material will have any advantage over other resistant stocks being tested. Sources of resistance to *Fusarium* wilt are being sought among local strains. A drought and an associated build-up of aphids revealed considerable variation among the Albar strains in their ability to withstand and recover from these conditions. Forty-eight strains selected from three trials at Ilonga show high jassid resistance and ginning outturn; lint quality is generally satisfactory in the selections being made, but in IL58 [XXX, 191], the greater length, strength and fineness of the fibres appears to be associated with an increased tendency to neppiness.

Castor oil plant. Selection of dwarf and giant varieties continued at Ismani where a promising giant selection is being bulked for further trials. Giant varieties appear to be more resistant than dwarf types to damage caused by *Lygus vosseleri*, possibly because of the greater thickness of the capsule in the former. The tolerance of insect attack observed in locally occurring wild castor-oil plants is thought to be physiological; relatively severe damage is needed to cause fruit drop in such plants.

Sesame. Venezuela 51 and Venezuela 52 are the most promising of the imported varieties tested. Morada [Purple], also received from Venezuela, is a branched selection from an African variety; it has given significantly higher yields than local varieties, is resistant to lodging and aphid attack, and suffers only lightly from *Cercospora* and *Alternaria* diseases. Two indehiscent varieties from the USA were undesirable in all other characters; a long back-crossing programme is being undertaken to transfer the indehiscent character to commercial varieties.

Soya bean. Lines from a single-plant selection of Hernon 237 have outyielded the parent variety in three successive years and are being bulked for issue as Hernon Nachingwea. Single-plant selections from the segregating progenies of three crosses are now breeding true for height, habit, maturity and lodging resistance although most are still segregating for yield. The most useful cross was Light Speckled x Hernon 237, although a few lines from MIS28EB x R184 and Light Speckled x CNA also show promise. A leafy selection of indeterminate growth produced from the first cross is receiving attention as a potentially valuable forage or silage variety.

Verrigtinge van die Eerste Kongres van die Suid-Afrikaanse Genetiese Vereniging Julie 1958. (**Proceedings of the First Congress of the South African Genetic Society, July 1958**).
Pretoria 1958 : No. 7 : Pp. 109.

1431 *Gildenhuys, P. & Brix, K. Somatic instability, abnormal meiosis and apomixis in a Pennisetum species. (pp. 55–56). (Abst.).*

Observations on mitotic and meiotic irregularities and on apomixis in *P. dubium* are summarized [cf. XXIX, 1555, and XXX, 1567].

1432 *de Wet, J. M. J. Phylogenetic trends in the Gramineae. (pp. 62–65).*

Principal trends in phylogeny are discussed with reference to the following: cytology, leaf anatomy, epidermis, culm anatomy, organization of the shoot apex, embryo anatomy, root-hair development, response to isopropyl-N-phenyl carbamate, starch-grain structure and morphology.

1433 *van Schaik, T. Genotype-environment interaction in maize. (pp. 66–68).*

Ear weight was measured in 13 inbreds and 11 F_1 hybrids replicated 4 times. Analysis of variance revealed appreciable values for environmental variance and genotype-environment interaction and also showed that the inbreds were 2·5 times as variable as the hybrids, the last finding according with Lerner's theory of genetic homeostasis [cf. XXV, p. 102]. However, on transforming the ear-weight data to antilogs, the genotype-environment interaction disappeared and the inbreds and hybrids became equally variable.

1434 *Bogyo, T. P. A method of estimating additive and non-additive gene action in the inheritance of resistance to leaf blight of maize caused by* Helminthosporium turcicum. *(pp. 69–73).*

The method described by Sprague and Tatum [cf. XIII, 501] was applied at the Agricultural Research Institute, University of Natal, to evaluate the relative importance of genes conferring general and specific combining ability for resistance to *H. turcicum* (*Trichometasphaeria turcica*). Single-cross data revealed that in most inbreds genes conditioning general combining ability were more important than those giving specific combining ability. Additive gene effects therefore played a greater role than epistasis and dominance.

1435 *Vieira-da-Silva, J. B. Recurrent selection for protein content in Sahara maize. (p. 74).*

The variety Sahara was subjected to two cycles of selection for high and low protein content at the Instituto de Investigação Científica, Luanda, Angola. The effect of the first cycle was not significant, probably because of soil heterogeneity. In the second cycle, the high and low-protein populations were significantly different, with a mean protein percentage of 11·61 ± 0·23 and 8·75 ± 0·22, respectively. The ratio between the difference of the means of the second-cycle populations and the difference of the means of the original selections gave a heritability estimate of 0·57.

1436 *Rehm, S. Genetic control or biochemical induction of elaterase formation in cucurbits. (pp. 75–76).*

A cross between a bitter-fruited cucumber variety with high elaterase activity (EA) and a nonbitter type without EA produced a bitter F_1 with high EA. The F_2 segregated into nonbitter plants without EA and bitter plants with or without EA in a ratio of about 3 : 1. F_3 plants from a nonbitter segregate were all nonbitter and without EA. The F_3 from three bitter segregates with EA produced 76·5% bitter plants + EA and 23·5% without EA. The F_3 of three bitter segregates without EA segregated into nonbitter progeny without EA and bitter plants. Of the latter, 51% had EA and 49% lacked EA. Not a single individual with nonbitter fruits containing high EA has been found among a large number of types of *Lagenaria siceraria.* A cross between bitter (high EA) and nonbitter (low EA) calabashes gave rise to a bitter-fruited F_1 with the same EA as the bitter parent. The F_2 segregated into nonbitter plants without EA and bitter ones. Of the latter 90% had high and 10% low EA. A cross between *Cucumis anguria* (nonbitter, no EA) and *C. longipes* (bitter + high EA) gave an F_1 with bitter fruits containing high EA. The F_2 and back cross with *C. anguria* segregated into bitter plants with high EA and nonbitter plants without EA. The close correlation between the concentration of the bitter principle and EA in the developing fruits of the two species suggests that lack of induction by the substrate is the reason for the absence of EA in nonbitter fruits. The distribution of the bitter principle and EA in the fruits of *C. humifructus* provides further evidence that induction by the bitter principle is necessary for elaterase formation. The outer flesh is bitter and contains a considerable amount of EA, the inner pulp being nonbitter and without EA. Slices of nonbitter fruits placed in cucurbitacin solution for 24 hr. have however failed to show any induction of elaterase synthesis, possibly because a longer period of treatment was required. It is concluded that elaterase formation in the cucurbits depends upon genetic control and also upon induction.

1437 *Bogyo, T. P. & de Muelenaere, H. J. H. Preliminary investigations on the effect of the gene* Y *on the carotene content of maize seedling leaves.* (*pp.* 77–79).

It has been found in Natal that extraction of vigorous inbreds is easier in the case of yellow maize than in white, and that white conversions of yellow inbreds are usually inferior in vigour to the original yellow lines. Investigations were therefore carried out to discover whether the yellow and white types differ in total carotene content of the seedling leaves. The results of an analysis of (*a*) yellow and white parents and one single cross and three top crosses involving them and (*b*) white and yellow sister S_4 lines suggested that carotene content in the leaves is controlled by the same gene (*Y*) as is responsible for carotenoid pigmentation in the endosperm. Previous investigators have reported a high correlation between the chlorophyll and carotene contents and between chlorophyll concentration and total dry matter production in maize plants. Further investigations are required to confirm this possible means of explanation of the agronomic superiority more frequently found in breeding material of yellow maize.

1438 *Hofmeyr, J. D. J. & Geerthsen, J. M. P. Competitive pollen tube growth studies in* Zea mays *L.* (*pp. 80–82*).

White-grained varietal and inbred ♀ parents were pollinated with mixtures containing equal quantities of pollen from yellow and white inbreds and varieties. Equal numbers of white and yellow seed were expected, but a significant deviation from equality was usually detected. The data suggested a possible relationship between combining ability and pollen-tube growth. A yield test of the progenies also pointed to such a relationship, but since unfavourable climatic conditions led to chaffiness, the results of this trial are not regarded as conclusive [cf. XXVIII, 4190]. In another experiment, each of three white-grained inbreds used as ♀ parents was pollinated with mixtures of its own pollen and that of a yellow-grained inbred, the white grains thus produced being the result of selfing. On the basis of a possible relationship between combining ability and pollen-tube growth, a deficiency in number of white grains would be expected, which would be correlated with the low yield expected as a result of selfing. The results were not however consistently in agreement with this expectation, since, with K64, a significant excess of white grains was obtained, although the yield, as expected, was significantly lower than that produced by plants raised from the yellow grain. In a third experiment, 67 pollinations of a wide range of ♀ parents were made, using the same pollen mixture [Potchefstroom Pearl (white) + Teko (yellow)]. The ratio of yellow : white grains was inconsistent, suggesting an interaction between pollen tubes and maternal tissue. In addition, it was found from still other pollinations that the pollen of certain inbreds was superior in competition with pollen from other inbreds, but inferior in competition with pollen from varieties. This appeared to be the general rule among white inbreds but exceptions were found in the case of yellow inbreds.

1439 *Hofmeyr, J. D. J. Cytoplasmic factors and pollen tube growth of* Zea mays *L.* (*pp.* 83–86).

Data were obtained on the ratios of yellow : white grain produced by white-grained, maternal parents when pollinated with mixtures of equal amounts of pollen from white and yellow-grained sources (inbreds, single crosses or open-pollinated varieties). Except when mixed with pollen from inbred C56, pollen of the white American inbred 33–16 was inferior in competitive ability. It was assumed that this inferiority was due to the effect of cytoplasmic factors on pollen-tube growth. The results with mixtures involving single-cross pollen sources with 33–16 as ♀ or ♂ parent confirmed this supposition. The cytoplasmic condition in the pollen-tube was susceptible to modification by interaction with genes, as indicated by the differential response of 33–16 cytoplasm to the contribution of the inbreds E58 and K64 in single crosses used as pollen sources. Cytoplasmic factors also appeared to be responsible for the poor competitive ability of the pollen of two other inbreds, C56 and Mexico 155.

Fourteen pollinations of 33–16 and Potchefstroom Pearl with the same pollen mixture (33–16 + American yellow inbred Hy) were effected. The ratios of yellow : white grains for the two ♀ parents were respectively 4·1 : 1 and 9·6 : 1. The heterogeneity in maternal effect between the two groups of pollinations and within each of the groups was significant.

1440 *Pienaar, R. de V. Manlik-onvrugbaarheid in Suid-Afrikaanse uievariëteite.* (*Male sterility in South African onion varieties*). (*pp. 87–90*).

With the exception of Texas Grano, which had no male-sterile plants in a population of 1500, eight varieties grown in South Africa had frequencies ranging from 1 out of 670 plants to 47 out of 2056. From these figures and the frequencies in the open-pollinated progenies, the frequencies of the nuclear gene *ms* and the cytoplasmic factor *S* were calculated for six of the varieties, on the assumption that male sterility was governed by the same factors as in Netherlands, American and Turkish varieties. Test crosses showed this assumption to be correct and also allowed *ms ms* plants carrying the cytoplasmic fertility factor *N* to be detected. The frequency of male sterility in South African material is appreciably greater than has been found in American and Netherlands varieties. Even higher frequencies, reaching 3 out of 11 plants in Dorata di Parma [Parma Gilt], have been found in Mediterranean material grown at Stellenbosch.

1441 *van Elden, H. Genetiese aspekte by saad en saadondersoek.* (*Genetical aspects of seed and seed investigations*). (*pp. 91–93*).

Published work on the following topics is briefly reviewed: the inheritance of duration of seed viability; the increase in mutations and chromosome disturbances with age of seed; and the genetic effects of seed treatments and storage conditions.

1442 *Brett, P. G. C. Some observations of sugarcane seedling selection in South Africa.* (*pp. 94–97*).

The procedure used at present in seedling selection at the Experiment Station of the South African Sugar Association, Mount Edgecombe, is outlined. On the basis of experimental data, suggestions are made as to modification of the procedure, with a view to reducing the possibility of discarding potentially valuable seedlings at the initial stages of selection. The proposed changes consist essentially of increase in the intensity of selection in microplots instead of single rows, combined with selection on a regional basis.

1443 *Höjby, H. R. New lines in tomato breeding.* (*pp. 98–100*).

Trials at Nelspruit and Kaapmuiden, Pretoria, have strongly suggested that it would pay to grow F_1 hybrids [cf. XXIX, 3223]. Two methods of producing lines which possess the functional or positional type of pollen sterility controlled by the gene pair *ss* are described from the theoretical and practical points of view. From the initial cross with the *ss* source to the production of the required male-sterile type, method A, comprising alternate selfing and back crossing, takes 11 generations and involves a total of 72 plants. Method B, consisting of continuous back crossing, requires seven generations and necessitates growing a total of 289 plants. The development of hybrid varieties, entailing crossing the sterile and fertile parents, testing and seed production for commercial use, takes from six to eight generations, as against the 11–17 generations required to develop varieties by hybridization and selection.

1444 *Kerkhoven, G. J. Cotton breeding for the Bushveld area.* (*pp. 101–03*).

Twelve agronomic and technological characters required in varieties of *Gossypium hirsutum* for the Bushveld area in the Transvaal, Swaziland and northern Natal are discussed. Loco–I (Muka A619 x Umu A455) and Loco–II (Muka A860 x Umu A456), produced in 1953 and 1956 respectively, show promise of meeting all these requirements.

1445 *Reusch, J. D. H. The effect of gamma irradiation on the breeding affinities of* Lolium perenne *and* Festuca pratensis. (*p. 104*). (*Abst.*).

[Cf. XXX, 4006].

1446 *Basson, J. K. 'n Eenvoudige saadbestralingsapparaat met 'n bron van 1 curie kobalt-60. (A simple apparatus for irradiating seed with a 1-curie source of cobalt-60). (pp. 105–06). (Abst.).*

The apparatus described is a drum of about 25 cm. in diameter and 25 cm. in length, with a central tube in which the γ-radiation source may be placed. The drum holds up to 20 lb. groundnut seed and can be rotated at a rate of about 10 times a minute to allow even irradiation of the seeds. Measurements of dosage by means of a Fricke ferrous sulphate dosimeter and pieces of X-ray film showed that doses of up to 21,000 r. could be administered and that the standard deviation of the doses received by the individual seeds was within the limits of experimental error.

1447 *Tuchlenski, H. Groundnut breeding with special reference to production of mutations. (pp. 107–09).*

Breeding at the Agricultural Research Institute, University of Pretoria, is described. The main aim is resistance to rosette virus. None of the many introductions tested has shown resistance. Hybridization between Natal Common ($2n = 40$) and *Arachis glabrata* ($2n = 40$) was unsuccessful. The R_2 derived from seeds of Natal Common exposed to γ radiation from Co^{60} is to be tested for rosette-resistant mutants.

1448 **Annual Report of the Department of Agriculture, Nyasaland, for the year 1958/9** (1960) : Part II : Pp. 158.

Maize. The hybrid Mthenga (LH7) confirmed its earlier promise and will now be grown on a commercial scale. The synthetic variety Mlonda, which is resistant to *Puccinia polysora*, has again given high yields and is recommended for hotter areas of the protectorate. Asikari, a synthetic designed for general use in the main maize-growing area, appreciably outyielded the standard variety Namalenga. In variety trials at five stations the highest yielders were the group of local hybrids numbered 6 to 15; all, except LH10, were bred from combinations of Southern Rhodesian, Mexican and local material. LH10 is a top cross between the open-pollinated variety Namalenga and a Mexican inbred. In this season's trials Mthenga was outyielded by LH11 which is of comparable quality.

Cotton. Of 21 selections from Albar 637 and related Albar strains [cf. XXX, 2341], six equalled or exceeded A637 in yield and had better jassid resistance. Jassid-resistant selections from the F_2 of the Albar 51 crosses are being tested for resistance to bacterial blight. Three selections from the Albar 49 crosses, ABC40, ABC146 and AC31, are being retained for further tests.

Coffee. In trials of 26 imported varieties at Bvumbwe, the Kenya selections SL28, SL34 and SL14 gave the highest yields. Overcropping however occurred in many varieties, including SL34. Large-leaved high-yielding varieties were most severely affected by leaf-miner attacks while small-leaved lower-yielding varieties with abundant foliage were least affected; among the latter KP228 was outstanding. In the Chola region, which is warmer and wetter than Bvumbwe, the most promising selections were Ke20 and SL6 from Kenya, and N5, N39 and N197 from Tanganyika.

Groundnut. Trials of varieties are reported and recommendations are made for various regions.

Soya bean. Among the introduced varieties tested at Bvumbwe, Hernon 107 and Hernon 147 from Rhodesia and 51S137 and 54S70 from the Transvaal were retained for further trials.

1449 **Report of the Secretary to the Federal Ministry of Agriculture, Federation of Rhodesia and Nyasaland for the year ended 30th September, 1959** (1960) : Pp. 212.

Wheat. Breeding at the Agricultural Experiment Station, Salisbury, S. Rhodesia, was continued [cf. 202]. At the Sabi Valley Experiment Station, negligible rust damage was recorded on the Angolan strain H–2–50.

Maize. In variety trials conducted by the Gwebi Agricultural College, SR1 was outyielded by some of the new hybrids, in particular 58H1; the latter also has a high total plant weight indicating a potentially high silage yield and should prove a good dual-purpose type. A short hybrid 58H3, which grows to a height of 6–7 ft. and produces very large ears, is also mentioned. Both of the new hybrids showed considerable resistance to *Helminthosporium turcicum* (*Trichometasphaeria turcica*), and 58H1 also had good resistance to *Puccinia sorghi*; 58H3 was more susceptible to the latter. Root lodging was insignificant in both hybrids, but while 58H1 showed little stem lodging 58H3 was less satisfactory in this respect.

Grasses. A new strain of *Panicum maximum* known as Sabi Panicum was released from the Grasslands Experiment Station. Mention is made of a "Shamva" selection of *Digitaria* which is said to seed moderately well and to be so profusely stoloniferous that it quickly forms a dense sward.

Mucuna. Seed of indigenous *Mucuna* species were obtained from various parts of the Federation and tested for resistance to *Phytophthora dreschleri*. All the material proved susceptible, with the exception of one collection of *M. pruriens* from the Sabi Valley which showed sufficient resistance to justify its use in a breeding programme.

Cotton. On the basis of its performance in district variety trials in Northern and Southern Rhodesia, Albar 637 is being issued for wide-scale planting and will probably replace the old U4 varieties. At the Gatooma Research Station, Albar derivatives and strains from the cross MU8A x BP52^2 (termed BMA strains) were included in small-bulk trials for the first time; it is anticipated that Albar 637 will only be in cultivation for about three seasons before being replaced by one of the BMA strains. To increase boll size, the large-bolled American variety Arkot 2–1 was crossed with Albar 637 and MU8A.

Kenaf. A collection of 115 strains obtained from 27 countries was grown at Gatooma; several promising strains originating mainly from the USA and Cuba were selected for comparison in wide-spread trials in Northern and Southern Rhodesia.

Apple. Of four varieties tested for reaction to various copper fungicides, Rhode Island Greening and White Winter Pearmain showed most damage while Versfeld and Red Delicious showed little.

1450 Annual Report of the Department of Agriculture, Northern Rhodesia, for the year 1959 (1960) : Pp. 24.

Wheat. Selections from Kentana 51B show promise of resistance to *Helminthosporium sativum* (*Cochliobolus sativus*).

Groundnut. The variety Mani Pintar continues to do well; used as the standard variety in three variety trials, one involving mainly runner types, one mainly bunch types, and one "early bunch" types, it headed the list each time. A new red Mani Pintar strain which yields almost as well as the parent variety is being bulked for distribution.

1451 Progress Report of the Cereal Crops Division, Experimental Farms Service, Canada Department of Agriculture, for 1954-58 : Pp. 39.

Wheat. A number of breeding programmes are described briefly. At Winnipeg, a project to incorporate rust resistance into hard red spring wheat varieties is in progress; at Lethbridge, major emphasis is placed on breeding wheats with sawfly and drought resistance; and at Lacombe, Alta., varieties with early maturity, high yields and satisfactory bread-making quality are being bred. The origin and qualities of a number of new varieties released during 1954–1958 are described, among them Selkirk [cf. XXIV, 1786] and Lake [XXIV, 2810].

The breeding of improved varieties of amber durum wheat is under way at Winnipeg. The variety Kenhi [XXIX, 2473], selected at the University of Alberta, is now the principal soft white spring wheat. It has been shown at Lethbridge that root-rot infection predisposes the crop to winter killing. Kent [XXVIII, 289] and Richmond [XXIV, 1864] are described.

Studies on the genetics of rust resistance are under way at Winnipeg and at the University of Saskatchewan. The chromosome substitution method is being used at the University of Alberta to analyse the genetic basis of quantitative and qualitative characters in wheat. Results of a monosomic analysis of winter growth habit, conducted by the Cytogenetics Unit at Ottawa, are outlined briefly.

Buckwheat. Selection of improved lines of smooth-hulled buckwheat is in progress. In 1955, two high-yielding, large-seeded selections of the Japanese type were bulked and distributed as the variety Tokyo [XXVI, 1025].

Oats. Some of the problems in oat breeding are discussed, with particular reference to the appearance of new races of pathogenic fungi. The following new oat varieties were added to recommended lists during 1954–1958; Vicar [XXVII, 1658], Shield [XXVII, 3880], Fundy [XXVII, 1657], Glen [XXVII, 3880] and Simcoe [XXIV, 1735].

Information is provided on changes in the prevalence and distribution of a number of races of stem and crown rust; and on a search for new sources of resistance to these diseases. Intensive studies of yellow-dwarf disease have revealed that there may be differences in tolerance to this virus among the common oat varieties. One of the objectives of oat breeding at Ottawa and at the Charlottetown Experimental Farm, Prince Edward Island, is the development of varieties resistant to *Septoria avenae* (*Leptosphaeria avenaria*); various methods being used to locate genes conferring resistance are described. A number of foreign introductions, which have shown some resistance to lodging, are listed.

The methods available for transfer of useful genes from diploid to hexaploid species of *Avena* are discussed.

A study of the morphology of the oat chromosomes and the establishment of caryotypes for *Avena* species have been undertaken by the Cytogenetics Unit at Ottawa. The caryotype of the diploid species (excluding *A. longiglumis*) is designated A; that of the tetraploids, AB; and that of the hexaploids, ACD.

Rye. Improvements in winter hardiness, yield and grain quality are being emphasized in a cooperative winter-rye breeding programme. A study of chromosome behaviour and fertility in Tetra Petkus is reported.

Barley. The major breeding programmes are described briefly. Studies on factors influencing malting quality have been conducted at the Malting and Prediction Laboratory, Winnipeg. A number of varieties resistant to the races of *Rhynchosporium secalis* occurring in Alberta are listed. The Canadian Genetic Stock Collection, which now contains 550 entries, is being screened in an effort to find sources of resistance to *Septoria* and *Helminthosporium* spp. A number of varieties and crosses have shown resistance to certain races of the common root-rot organism, *H. sativum* (*Cochliobolus sativus*), while others have shown immunity to some or all of the North American races of loose smut, *Ustilago nuda*.

The variety York has shown some resistance to the Ottawa strain of the yellow-dwarf virus; and a number of crosses, involving Mianwali and N–C–13–13, have been selected for resistance to the barley jointworm, *Harmolita hordei*. Some promising hybrid material involving *Hordeum leporinum* has been obtained as one result of a programme designed to transfer desirable characteristics from wild to cultivated barleys.

The following varieties, which were released between 1954–1958, are described; Kenata [XXV, 1990], Hudson [XXIV, 330], Nord [XXVIII, 207], Parkland [XXVI, 2326], Swan [XXVII, 3880] and York [XXVIII, 3997].

Cytological studies on *Hordeum* spp. and on various interspecific and intergeneric hybrids are reported.

Flax. The wilt and rust resistance of linseed varieties has been successfully transferred to fibre types. Several selections of the cross (Riga Blue $5A_3$ x Bison) x Norfolk Queen were outstanding for yield and fibre quality.

Linseed. A number of rust-resistant, early-maturing lines with high yielding capacity have been selected. Sources of resistance to aster yellows are being sought. Environmental influences have been found to influence the composition of linseed oil; projects to provide information on the inheritance of the acid fractions have been initiated. Differences in varietal response to red-light radiation and temperature were noted. Studies on haploid and tetraploid flax plants are reported.

Safflower. A number of high-yielding lines have been selected and are currently undergoing further testing.

Bean. A number of interesting hybrids have been obtained by crossing blight-resistant introductions from South America with anthracnose-resistant lines.

Pea. The morphology of the chromosomes of *P. sativum*, and their behaviour during meiosis, have been studied.

1452 **Progress Report of the Forage Crops Division, Canada Department of Agriculture, Ottawa, Ontario, Canada 1954-1958** (1960) : Pp. 62.

Maize. A number of new Canbred yellow dent hybrids were released in 1958. These early-maturing, high-yielding hybrids have shown some resistance to stalk rot. Nine established inbreds were converted to the cytoplasmic male-sterile condition (T-type) by back crossing during 1954–1958. Work on the transfer of the restorer gene, or genes, to a limited number of established inbreds is in progress. A study was made of the haploidy method of isolating homozygous lines.

Grasses. Frontier reed canary grass (*Phalaris arundinacea*) [cf. XXX, 2759] and Norlea perennial ryegrass [XXVIII, 4288] have been released. Improved strains of meadow, tall and red fescue are undergoing further testing. Two clones of timothy, with some resistance to brown stripe (*Scolecotrichum graminis*), have been selected. Considerable promise has been shown by a medium-maturing cocksfoot variety, Ottawa 200, and by a late-maturing variety, Ottawa 100. Preliminary studies on the relationship of root development to top growth in different clones of cocksfoot are reported.

Lucerne. Objectives of the lucerne-breeding programme are discussed. Studies on male sterility have indicated that this character can be used with complete reliability for all crossing studies. Stem cuttings have been irradiated in an attempt to induce genetic variability and specific mutations. The effects of irradiation on pollen and dormant seeds have also been studied; increases in mutation frequency and in the variability of quantitative characters were noted. Preliminary studies on the nature of resistance to the northern root-knot nematode (*Meloidogyne hapla*) are reported.

Red clover. Some progress has been made in breeding for resistance to crown rot (*Sclerotinia trifoliorum*) and powdery mildew (*Erysiphe polygoni*). Attempts are being made to find a technique for screening seedlings resistant to *Fusarium* root rot. In laboratory tests, tetraploid red clover and Alsike clover varieties showed less cold resistance than did diploid types; these differences were not, however, observed in field trials. Details are given of a study of changes in fertility in tetraploid red and Alsike clover in ten successive generations. The results of varietal trials at ten Experimental Farms are presented in tabular form.

Ladino clover. Resistance to *Fusarium* root rots, *Sclerotinia* crown rot and *Typhula* snow mould are among the major objectives in a breeding programme, which has now reached the third cycle of selection.

Alsike clover. A comparative study of a number of characters in diploid and tetraploid populations is reported. Under field conditions, the proximity of diploid plants was found to have an adverse effect on the seed yield of tetraploids.

Birdsfoot trefoil. A world collection of potential breeding material was made and a nursery of 200 lines has now been established. A photoelectric leaf-measuring device has been used successfully in a genetic study of leaf size.

Soya bean. The objectives of the breeding programme are discussed. A new variety, Crest, was released in 1957 [cf. XXVIII, 1040].

1453 **84th Annual Report of the Ontario Agricultural College and Experimental Farm, 1959** : Pp. 107.

Oats. The newly-released variety Russell is equal to Garry in yielding ability, produces better quality grain and has greater tolerance of *Septoria* disease than either Rodney or Garry.

Strawberry. Inbred lines without runners have been selected.

Cucumber. An improved form of the variety Hycrop Hybrid is to be released in 1960. It is highly resistant to both mosaic and spot rot but is moderately susceptible to bacterial wilt.

Tomato. Tanggula, an F_5 selection of Harrow x Striped Mutant, has a high external and internal colour rating, is resistant to blemish and possesses the "concentrated maturity" characteristics. A half-wild cross of Campbell Soup 128 x Philipino 2 has exceptionally deep colour and will set fruit at 45° F., a temperature of 10° below normal for tomatoes.

Report of Western Forage Crops Conference, Winnipeg, Manitoba, June 26 and 27, 1959. Pp. 82. (Mimeographed).

1454 *Peake, R. W. Breeding orchard grass.* (*pp. 10–12*).

The performance of a number of lines of *Dactylis glomerata*, specially selected for winter hardiness at Lethbridge, Alta., has been compared with European and American lines at four Canadian stations. The results indicated that the new Lethbridge lines will be of value where the need for winter hardiness and spring vigour is likely to be important. Elsewhere, less winter-hardy, but more productive lines are preferable. The four outstanding Lethbridge lines, L924, L925, L926 and L932, have now been combined into one synthetic variety, L1175.

1455 *Doran, W. J. Testing forages in pure stand, simple or complex mixtures.* (*pp. 21–22*).

It is pointed out that pure-stand testing can yield useful information on differences between varieties or strains. However, the final critical assessment of a forage crop must be based on its ability to perform in a mixture.

1456 Informe anual de labores, 1959. (**Annual report of activities, 1959**).
San José, Costa Rica 1960 : Pp. 118.

Maize. The outstanding varieties in yield trials were DAMA 1 and DAMA 2.

Rice. Eight early-maturing lines have been obtained and have shown high yielding capacity and very low susceptibility to *Cochliobolus* and *Piricularia*. Among other new selections is Dacori (BR x R–BR), a short-grained, high-yielding variety which is also partly resistant to the above two fungi as well as to shedding.

Potato. Only 16 clones now remain out of 63 clones previously selected for resistance to blight [cf. XXX, 1190]. The remainder have been discarded because of their great susceptibility to virus diseases. Two clones originating from abroad, Chicua (HIQ–1) and Irazu (HLT–6), have been registered locally because of their resistance to blight.

French bean. In a trial of 136 lines, 8N, Mex 21N, Mex 24N and Mex 27N gave promising results.

1457 **Report of the Governing Body and the Principal's Report of the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, for 1958-59** : Pp. 68.

Sweet potato. Observations on a collection of cultivars has resulted in the elimination of the vast majority because of their unsatisfactory yield. The best seedlings were derived from 20/56 (Red Nut), a Trinidad cultivar, and from 07/56 (B34), a cultivar which shows marked resistance to *Megastes* attack.

Aroids. In a trial of *Xanthosoma* cultivars, the highest yielding was 22/57 (Barbados), while the finest storing and eating quality was found in 13/56 (Chackelle). Mumu, a *Colocasia esculenta* cultivar obtained from Fiji, exceeded the yield of the Trinidad Purple or Common dasheen; its cooking quality, however, was less satisfactory.

Cacao. The most prolific of six Trinitario-Scavina hybrids was again ICS6 x SCA6, which yielded 2781 pounds of dry cacao per acre from 154 bearing seedlings (160 were originally planted). Flavour assessments of the produce of these crosses were not encouraging. The results are also presented of a trial involving six crosses between Trinitario selections and clonal cuttings of eight of the parents involved in these crosses. Highest yields were obtained from ICS89 x ICS8 and, among the parents, from ICS39 and ICS40.

Banana. In male parent breeding, crosses of wild Samoan introductions with edible diploids have continued to yield a proportion of outstanding seedlings. The Samoan plants, although apparently truly wild and normally very seedy, exhibit a low degree of parthenocarpy. As a means of further increasing the diversity of banana breeding stocks, a Pahang strain of *Musa acuminata* has been introduced.

1458 **Annual Reports of the Ministry of Agriculture and Lands, Jamaica, for the years ending 31st December, 1957** (1959) : Pp. 81; **1958** (1960) : Pp. 92.

Banana. Breeding and testing seedling varieties at Bodles continued. Many improved ♂ parents for crossing with Gros Michel have been developed from material collected in Africa and the Far East. Some of these produce such promising-looking fruit themselves that their arrival has brought new hope of producing a worthy successor to Gros Michel in the near future.

Abstracts of the Annual Meeting of the American Society of Agronomy, Chicago 1960 : Pp. 79.

1459 *McCollum, R. E. Evidence for and implications of a genetic factor for chloride accumulation by soybeans.* (*p. 21*).

Evidence has been obtained that chloride accumulation in the aerial part of soya-bean plants is subject to genetic control. The chloride content in root tissue was however nearly the same in the three varieties examined.

1460 *Stith, L. S., Kreizinger, H. F. & Abbott, J. L. Interrelationship of sorghum varieties and nutrients.* (*p. 23*).

Hybrid sorghums belonging to the early, medium and late maturity groups, together with an open-pollinated variety in each of these groups, were given various fertilizer treatments. No support was gained for the hypothesis that the nutrient requirements of the maturity groups would differ and that the hybrids within each group would respond differently from the open-pollinated variety.

1461 *Alexander, D. E. Characteristics of elongate-derived autotetraploid corns.* (*p. 44*).

As already reported, autotetraploids have been synthesized by exploiting the effect of the "elongate" (*el*) gene [cf. XXIX, 927]. Tests of the 4*x* varieties and of crosses between slightly inbred 4*x* lines for a three-year period indicated that (1) seed-set percentage increases in the autotetraploids with each generation of random mating, (2) the 4*x* varieties and hybrids mature in about the same period as the diploids from which they were derived, and (3) some 4*x* hybrids give relatively high yields.

1462 *Anderson, R. E. & Boonsue, B. Effects of X-ray and thermal neutron irradiation of alfalfa seed on the* X_1 *generation.* (*p. 44*).

Dormant seeds were exposed to X rays and thermal neutrons, and the morphological and cytological effects in seedlings and mature plants determined. Examination of root tips showed dicentric chromosomes and acentric fragments to be the most common aberrations. The frequencies of abnormal anaphase cells in mitosis increased proportionally with the dose. In meiosis, the percentage of cells containing laggards increased slightly at both telophase I and II with the higher doses. The proportions of abnormal pollen grains also increased with dose. X-ray treatment caused greater variation in seedling height and less killing than thermal neutrons, but the cytological effects of the two types of radiation were similar.

1463 *Bagshaw, F. M. & Rossman, E. C. Performance of two-eared inbred lines of corn in three-way hybrids.* (*p. 44*).

In investigations at Michigan State University, two early-maturing single-eared inbreds were crossed with several prolific inbreds, hybrids and open-pollinated varieties from the southern USA. Inbreeding and selection for two or more ears per plant resulted in a group of S_3 inbreds which were test crossed with an adapted single cross (Oh 51 x Oh 26). The three-way hybrids were evaluated in two localities during 1958. The percentage of two-eared plants ranged from 77·8 to 0%, depending upon the hybrid, density of population and locality. The mean percentage of two-eared plants declined as the population increased. In 1959, better entries in the 1958 group and 95 S_1 inbreds of similar origin crossed to the same tester were evaluated. Some relatively early-maturing lines contributing a high percentage of two-eared plants in the test-cross progenies were obtained. Several inbreds contributed significantly more yielding capacity to the tester than WF9. The increased yield appeared to be derived from the southern germ plasm, since neither of the parental cornbelt inbreds added significantly to tester yield.

1464 *Bhatnagar, P. S. & Jugenheimer, R. W. Breeding for extremes in lodging in corn by reciprocal recurrent selection. (p. 44).*

The initial material consisted of all possible 153 single crosses among 18 inbred lines in each of two unrelated stocks. According to data on replicated and randomized single-hill performance, each of the two stocks was further subdivided into a group of lines with a low degree of lodging and another group with a high degree within each stock. The five selected lines in each group for lodging were crossed among themselves in all possible combinations to give ten F_1s. Selfing of these hybrids resulted in ten second-cycle lines for low degree of lodging and ten for a high degree in each stock. In 1958, lines from both cycles were outcrossed to appropriate testers. In 1959, crosses and lines were tested in two trials. After two cycles of reciprocal recurrent selection, the mean percentage of erect plants for the original population was respectively shifted from 71 to 83% and to 29% in the low and high lodging categories in one stock. The corresponding figures for the other stock were 62, 81 and 32%. It is concluded that these shifts were genetic and the outcome of the selection applied during two cycles.

1465 *Blair, B. O. & Patterson, F. L. Response of vernalized wheat to temperature and day length in relation to breeding and adaptation. (p. 45).*

Vernalized plants of wheat varieties were grown at 60°, 70° or 80° F. with 12, 16 or 20 hr. days. Considerable varietal differences in response to temperature and day length were observed. Knox types were outstandingly well-adapted to nearly all conditions, confirming the wide adaptation of Knox. LaPorte, in contrast, was particularly restricted in floral development with a 12-hour day. Such data on the response of vernalized plants to temperature and day length may be useful in predicting varietal adaptation.

1466 *Brewbaker, H. E., Oldemeyer, R. K. & Bush, H. L. Advances in sugar beet breeding. (p. 45).*

Recent advances in sugar-beet breeding by the Great Western Sugar Company, USA, are outlined.

1467 *Briggle, L. W. Sources of resistance to powdery mildew from tetraploid* Triticum *species. (p. 45).*

Triticum dicoccum 'Khapli' and 'Vernal' and *T. durum* 'Yuma' have so far shown resistance to powdery mildew (*Erysiphe graminis* var. *tritici*) in all seedling and field tests. Preliminary data indicate that a single completely dominant gene is responsible for resistance in Khapli and Yuma, inheritance of the resistance of Vernal being more complex. An attempt is being made to transfer resistance from these three sources to the hexaploid wheats Chancellor and Vermillion.

1468 *Brown, A. R. & Morris, H. D. Plot technique for grain sorghum yield trials. (p. 45).*

Two years' data have indicated that use of 4 rows with a row length of 5 ft. or 2 rows with a row length of 15 ft. per plot is the most efficient technique for trials in Piedmont, Ga. [cf. 1543].

1469 *Brown, J. A. M. & Pickett, R. C. Clonal evaluation in* Phalaris arundinacea: *I. Variation in palatability. (p. 45).*

In 1957, 40 genotypes of diverse origin were established in replicated plots at Purdue University. In 1958, the second regrowth was grazed with sheep for 24 hr. Random 100-tiller samples of the regrowth were taken before and after grazing. Significant variation between genotypes and replication x genotype interactions were obtained for change in tiller weight due to grazing. Leaf-stem ratios, tiller weight before grazing, plot vigour and leaf colour also varied widely. The first regrowth was grazed in June 1959. After 60 hr. of grazing, tiller-weight loss averaged 8·9% in the three most unpalatable genotypes and 76·1% in the three most palatable; these disparities persisted in the second regrowth. Unpalatable genotypes showed some tendency to have higher contents of water-soluble phenolic compounds than palatable ones.

1470 *Craigmiles, J. P. Development, maintenance and utilization of a male-sterile Sudangrass.* (*p. 46*).

As already reported, a male-sterile type of Sudan grass has been developed by transferring the cytoplasmic sterility of Combine Kafir 60 (*Sorghum vulgare*) to Rhodesian Sudan grass (*S. arundinaceum*) by a series of back crosses, using Rhodesian as recurrent parent [XXIX, 1557]. Rhodesian was the only Sudan grass tested which did not carry factors for restoring fertility. Pollen contamination of either the Rhodesian sterile form or its fertile counterpart by Sudan grass causes restoration of fertility. If contamination occurs, it is necessary to self the fertile counterpart, hand pollinate the sterile line and progeny test for fertility. Results of tests for three years at four centres have shown hybrid Sudan grass to be more productive than any other variety tested.

1471 *Crumpacker, D. W. & Allard, R. W. The use of* F_1 *hybrids to predict segregation patterns for heading date of wheat.* (*p. 46*).

[Cf. 1699].

1472 *Dewey, D. R. The nature of polyploidy in* Agropyron desertorum. (*p. 46*).

The frequency of quadrivalents (0–5 per cell) at diacinesis and metaphase I indicates that *A. desertorum* ($2n = 28$) is at least partially autotetraploid. Critical evidence as to the type of polyploidy was obtained from a polyhaploid ($2n = 15$), discovered among 142 twin plants. Chromosome pairing at diacinesis and metaphase I was good, with an average configuration of $0{\cdot}26_{III} + 6{\cdot}56_{II} + 1{\cdot}11_{I}$. Obviously the polyhaploid contained only one genome. The plant produced only one seed in two years, this sterility probably being the result of chromosome deficiencies which had arisen in the autotetraploid condition. Other evidence of the autotetraploid nature of the species was derived from its hybrids ($2n = 35$) with *A. repens* ($2n = 42$). Disparities in chromosome size between the parental species permitted identification of their respective chromosomes throughout meiosis. The 14 chromosomes of *A. desertorum* consistently formed 7_{II}.

1473 *Dollinger, E. J. Differential fertilization involving the* Y_1 *and* Su_2 *loci on chromosome 6 in maize.* (*p. 46*).

Considering the parental classes, an excess of white-sugary endosperms was obtained from back-cross progenies when the heterozygote was the pollinator ($y_1^{m}su_2$ or y_1su_2 x $Y_1Su_2/y_1^{m}su_2$); y_1^{m} is a mutable allele of y_1 [cf. XXX, 1218]. The excess of such endosperms was somewhat greater from the butt half of the ear, indicating that a gamete factor was involved. Progeny of selfed heterozygotes ($Y_1Su_2/y_1^{m}su_2$) gave approximate ratios of 3 yellow : 1 white and 3 nonsugary : 1 sugary. These were the expected ratios if no gamete factor was involved. Homozygous $y_1^{m}su_2$ and y_1su_2 stocks were recovered from outcrosses to the inbred lines Oh. 51A and Oh. 43. Considering parental classes only, three classes of ratios were obtained from the progeny when the heterozygotes $Y_1Su_2/y_1^{m}su_2$ were used as pollinators on recovered $y_1^{m}su_2$ or y_1su_2 plants. The three classes were those with (1) an excess of yellow endosperms, (2) an excess of white-sugary endosperms and (3) equal numbers of yellow and white-sugary endosperms. The data are explained on the basis of two gamete factors.

1474 *Drolsom, P. N. The effects of colchicine on gross morphological and physiological changes in sorghum.* (*pp. 46–47*).

The possible mutagenic effects of colchicine treatment have been studied for several years at the University of Wisconsin. The plants raised from treated seeds or seedlings have been selfed and the progenies examined for variations in morphological and physiological characters. Progenies of aberrants have been further studied. The varieties used more extensitvely were the sorghum Leoti and the Sudan grass varieties Tift, Sweet and Piper. All varieties have remained highly stable. Only a very low percentage of certain deviations from the varietal types has been noted and it is not certain whether these were the effects of the colchicine treatment.

1475 *Fergason, V. L. & Zuber, M. S. The influence of environment on the amylose and endosperm protein content of maize.* (*p. 47*).

A study was made of genotypes providing a range in amylose content from 26 to 70%. Each of the homozygous inbred lines and a single cross containing about 55% amylose were grown in eight different states for three successive years. The environmental factors associated with locality significantly influenced amylose production in high-amylose entries. Environmental conditions had no measurable effect on amylose percentage in inbred M14 which contained a normal content of about 26%. The environmental effects on amylose content were similar for the entire range represented by the high-amylose genotypes.

Protein content of the endosperm was also modified by the environment. Genetic differences in protein content were however greater than those ascribable to the effect of environmental conditions. Data for two of the years revealed no significant effects upon amylose or protein content attributable to year.

1476 *Franzke, C. J., Sanders, M. E. & Ross, J. G. Genetic studies of diploid nontrue-breeding mutants in sorghum obtained after colchicine treatment.* (*p. 47*).

Some diploid mutants which have arisen after application of 0·5% colchicine in lanolin to coleoptiles of seedlings of Experimental 3 have segregated for many characters when selfed [cf. XXX, 1225]. Segregation in the first and second generations of such mutants has been investigated. In general, ratios for individual characters in the three mutants analysed do not conform to a 1 : 2 : 1 relationship, an excess of homozygotes being obtained in eight out of nine cases. In six of these eight cases, the dominant allele originally present in Experimental 3 predominated. In another case the recessive mutant allele predominated, while in the remaining one "predominance was in both original dominant and mutant recessive alleles. Variations from the expectation for a selfed heterozygote also appeared in midrib color which appeared uniform for the mutant brown character in 1 of the mutants, and in the awned character which in 2 of the 3 mutants segregated for 3 alleles (awnless, tip-awned and awned)." Further evidence should indicate whether modifiers affect the expression of the single genes previously reported for these characters. The segregating mutants appear to be chimeral with homozygous and heterozygous sectors.

1477 *Gardner, C. O. Effects of mass selection and thermal neutron irradiation on an open-pollinated variety of corn.* (*p. 47*).

In 1955 a project was initiated at the University of Nebraska to reevaluate mass selection as a procedure and to assess the value of thermal-neutron treatment in mass selection. Irradiation was applied to one seed lot of the open-pollinated variety Hays Golden; a second sample of this variety served as control. The irradiated population was subjected to further irradiation of the seed in 1957. The two populations have been grown in isolation, and each year 10% of the plants have been selected for high yield, for advance to the next generation. Yield tests with 20 replications have been carried out on each cycle of selection, together with the original variety. Significant increases in yield have resulted from mass selection in both the control and irradiated material. After four cycles of selection, both populations outyielded the original variety by 22·8 and 20·2% respectively, in the 1959 test. Irradiation decreased yield in the year of treatment but improvement was made in all other years. The control has consistently outyielded the treated maize. After four cycles of selection, however, the difference is only 2·6 bushels. When the fourth-cycle seed of both the control and irradiated populations was irradiated, the previously treated one yielded significantly more than the control.

1478 *Genter, C. F. & Alexander, M. W. Comparison of S_1 progeny and test-cross performance in corn.* (*p. 48*).

S_0 plants of two synthetic varieties were selfed and crossed with two unrelated single-cross testers, WF9 x T8 and Hy3 x C103. Trials were then carried out at Holland and Blacksburg, Va., to compare the S_1 progenies with the respective test crosses, correlations between S_1 and mean test-cross performance being calculated for several characters. Correlations averaged 0·60 for both yield and kernel moisture and 0·50 for grain quality at Holland under fairly good conditions for growth. Correlations for these characters were somewhat lower at Blacksburg, where severe drought prevailed during the second half of the growing season. Correlations of 0·74 and 0·73 were respectively obtained for percentages of root and stalk lodging in one set of comparisons at Blacksburg, where the incidence of lodging was fairly high. Progenies selected according to S_1 and test-cross performance will be intercrossed and carried through cycles of recurrent selection, using heterogeneous testers, to compare the advantages of the two methods of early selection.

1479 *Goplen, B. P. A recessive gene with major pleiotropic effects in sweetclover,* Melilotus alba *L.* (*p. 48*).

A mutant found in Canada in 1959 bore extremely large leaves with a wrinkled appearance. It depended upon a single recessive gene with major pleiotropic effects not only upon leaf size and morphology but also on the leaf : stem ratio, female fertility and hybrid vigour.

1480 *Grobman, A.* et al. *Breeding potential of corn germplasm of Peru.* (*p. 48*).

The general characteristics of 40 races from the coastal, highland and jungle regions of Peru have been determined [cf. XXIX, 2322]. Knowledge of evolutionary relationships among races is useful in planning schemes of multiple reciprocal recurrent selection with foreign varieties and within local races. Large-scale trials of intervarietal hybrids and top crosses have shown many entries to be high yielding. Some of the intervarietal hybrids have outyielded the best local varieties by well over 70%, although their parents are inferior in yield. Exploratory crosses of germ plasm from Brazil, the Caribbean region, Colombia, Mexico, Central America and the USA with Peruvian varieties have consistently displayed a high degree of heterosis for yield.

1481 *Harrison, R. L. & Jugenheimer, R. W. Efficiency of recurrent selection in breeding for resistance to the European corn borer. (p. 48).*

Two groups of inbreds were grown during 1959 in replicated single-hill plots at Urbana, Ill. Within each group were three cycles of material developed by recurrent selection. Each plant was artificially infested with borer eggs. The second cycle inbreds had a relatively high degree of resistance to leaf feeding by the first generation. Some improvement was secured in the third cycle but the magnitude of the increase was less than in the second cycle. The amount of infestation in the field was probably not high enough to differentiate between the most resistant plants belonging to cycles 2 and 3.

1482 *Heathman, C. E. & Alexander, D. E. The effect of semi-sterility on yield components of corn. (p. 48).*

The effect of reduced seed set on yield components was studied in populations segregating for reciprocal translocations. Data on yield per plant, yield per ear, ear number per plant, ear length, 100-kernel weight, row number and moisture percentage in the grain were analysed. Plants with 40–60% fertility yielded from 54 to 110% as much as normal segregates. The yields of the semisterile plants approached those of the normal segregates more closely as the planting rate increased; differences in yield also varied according to genotype and seed-set percentage. Reduction in seed set in the semisterile plants was offset by increases in seed size and number of second ears, as well as apparently by increased ear length in some genotypes. Semisterile segregates were consistent in having a higher content of sugar in the stalks 60 days after pollination and also a higher moisture percentage in the grain than their normal siblings. Differences between the two types of segregates were also found in lodging.

1483 *Heiner, R. E., Konzak, C. F., Nilan, R. A. & Legault, R. R. Diethyl sulfate induces a high mutation frequency associated with few chromosome structural aberrations. (pp. 48–49).*

Treatment of dormant barley seeds with diethyl sulphate was several times more effective than γ radiation in inducing mutations and had the advantage of producing only a few detectable chromosome aberrations. For similar seedling injury, survival of plants after diethyl sulphate treatment was greater than after γ radiation. Ear fertility decreased with duration of the chemical treatment. With the least effective treatment fertility was equal to that of plants from untreated seeds but the frequency of induced mutations was higher than that induced by the most effective γ exposure. Diethyl sulphate treatment caused a different spectrum of chlorophyll mutations from that incited by irradiation. Treatment with a similar mutagen, ethyl methane sulphate, also resulted in only a few chromosome irregularities.

1484 *Hinckley, R. A. & Keim, W. F. Inheritance of pubescence in* Lotus corniculatus *L. (p. 49).*

Two highly pubescent and five glabrous plants were intercrossed in several combinations. Degree of pubescence was determined on leaflets in the late seedling stage. Selected F_1 plants were back crossed to the glabrous parents. Since all plants were self sterile, use of the F_2 and F_3 was precluded. F_1 and back-cross data were respectively based on 5562 and 4687 plants. A complete range from highly pubescent to completely glabrous plants was observed and was apparently due to several different genes. Pubescence was dominant over the glabrous condition.

1485 *Jenkins, J. N. & Kramer, H. H. Differential pollen and egg transmission of the alleles at the ae locus on chromosome 5 in maize. (p. 49).*

"In 1955 self pollination of one plant produced 242 *susu Ae-* (wrinkled) to 3 *susu aeae* (full) kernels. This was repeated in the next generation of selfing, various ears yielding 1 to 3% full kernels. It was not known at the time if these parental plants were *susu aeae* or *susu + ae*. Self pollination of the full class gave only fulls. Experiments were conducted to determine if this behavior was due to: (1) the sugary background, the *ae* locus itself, or a closely linked factor; (2) mutation of *Ae* to *ae*; or (3) some type of pollen competition or lethality. In reciprocal crosses of *susu +ae* with *susu* *aeae* differential pollen and egg transmission of the wild type (*Ae*) and the recessive (*ae*) allele was observed. This same phenomenon was observed again in the progeny of both reciprocals thus making unlikely cytoplasmic effects. The differential pollen transmission was attributed to a gametophyte factor on chromosome 5. A genic element causing either (1) preferential segregation of the particular genotype into the basal megaspore, or (2) preferential development of the particular genotype into the embryo sac regardless of its position in the linear tetrad was proposed to account for the differential transmission through the eggs." [Cf. XXIX, 192].

1486 *Johnson, E. C. & Osler, R. D. Yield relationships between F_1 and F_2 generations of crosses among corn races of diverse origins in Mexico.* (*p. 49*).

Yield trials of the F_1, F_2 and parents of a series of crosses between widely divergent races were conducted during 1959 at Veracruz. F_2 yields varied from 27 to 250% of the F_1, the F_2 mean yield being 75% of the F_1. The average yield of the F_1 of all crosses was about 135% of the mean of the parents. The average yield of the F_2 was slightly above 100% of the mean of the parents. Essentially the same results were obtained whether or not crosses of unadapted parents were considered. The F_1 yields of certain crosses confirmed results in the previous year, when Harinosa de 8 [Eight-rowed Floury] x Tuxpeño equalled the hybrid now recommended for the area [cf. XXX, 1232]. Of the five crosses giving the highest two-year average yields, three involved the ancient races Harinosa de 8, Chapalote and Nal-Tel.

1487 *Josephson, L. M. & Kincer, H. C. Effect of male-sterile cytoplasm on yield and agronomic characteristics of corn inbreds and hybrids.* (*p. 49*).

Cytoplasmic male sterility of the Texas type and restorer genes were incorporated into five inbred lines, sterile and fertile versions being isolated after at least five back crosses to the normal inbred. Normal cytoplasm counterparts were obtained by pollinating the normal inbreds with the fertile versions. Plants with nonrestored sterile cytoplasm, restored sterile cytoplasm and normal cytoplasm were tested for yield and other characters as inbreds in single crosses. Differences in yield between the three categories, as inbreds or single crosses, were not significant. Sterile plants were 8 in. shorter than the fertile versions when tested as inbreds and 6 in. shorter as single crosses. Sterile plants were also significantly later in silking. Differences in moisture content of the grain at harvest were nonsignificant. Paired plants of the fertile and sterile versions, growing adjacent in the row, were compared in three segregating single crosses at two centres. The sterile versions yielded significantly more than fertile plants only in one comparison. They averaged 8 in. shorter than fertile plants in all comparisons but *t* values were nonsignificant for all other characteristics measured.

1488 *Kramer, N. W. Breeding methods for sorghum hybrids.* (*p. 49*).

The adaptability of maize-breeding procedures for the production of parental lines of F_1 hybrids of sorghum was considered from the theoretical and practical standpoints.

1489 *Krull, C. F. Genetic variability in oats following hybridization and radiation.* (*p. 50*).

The effects of thermal-neutron treatment upon variability in 100-kernel weight, date of heading and plant height in pure varieties and hybrid populations were determined. The N_1 was grown in the greenhouse to minimize the possibility of natural crossing and the next two generations were evaluated in the field. In general, irradiation increased variability in all three characters, both positively and negatively, in the hybrids and pure varieties. No consistent positive or negative shifts in skewness values were detected, suggesting that approximately equal numbers of beneficial and detrimental mutations had been induced. Consistent positive shifts in kurtosis values occurred for each character. The variability caused by irradiation was equally as heritable as that arising through hybridization.

1490 *Langham, D. G. The high-low method of crop improvement.* (*p. 50*).

Extensive breeding for 20 years with *Sesamum indicum* in Venezuela has indicated that the most effective method of enhancing the expression of a given character, such as pod length and insect or disease resistance, consists of crossing the best line for the particular character with the most inferior. In large F_2s of such crosses, selection is made at both ends of the transgression curve for the few plants showing extreme expression of the character. It is assumed that qualitative genes for a given character do not usually show their maximum effects because their action is buffered by specific modifier genes. Presumably, evolutionary processes lead to an accumulation of one type of buffer gene in the best lines and of another type in the inferior; only by crossing between the two extremes can the qualitative genes be freed from their specific modifiers to give an enhanced expression of the desired character.

1491 *Leffel, R. C. Plant lodging as a selection criterion in soybean breeding.* (*p. 50*).
Many previous studies have indicated positive associations of seed yield with maturity, height and degree of lodging. The results of two-year tests in which Dorman and S100 were subjected to simulated, artificially-prevented and natural lodging revealed no consistent relationship between seed yield and lodging.

1492 *Lindsey, M. F., Robinson, H. F. & Moll, R. H. The effects of repulsion-phase linkages on estimates of the average degree of dominance for genes influencing quantitatively inherited characters in corn.* (*p. 50*).
Paired back-cross progenies involving the F_2, F_8 and F_{13} of a cross between two inbred lines were grown simultaneously in replicated field experiments. Data were recorded on seven quantitatively inherited characters, estimates being made of additive genetic variance, dominance variance and average degree of dominance ($\bar{a}$) for genes influencing each of these characters. Estimates of $\bar{a}$ for genes affecting yield in the F_2 were in the overdominance range and significantly different from complete dominance. Similar estimates from the F_8 and F_{13} were not different from complete dominance. The presence of predominantly repulsion-phase linkages in the F_2 could cause an upward bias in the estimate of $\bar{a}$. Genetic recombination in later generations would permit reduction in the amount of linkage disequilibrium and cause reduction in the estimate of $\bar{a}$. The results for ear number, diameter, length and height and for plant height and date of flowering followed a pattern similar to that for yield. Estimates of $\bar{a}$ for these characters were not as high as for yield in the F_2 and showed some decline in the advanced generations.

1493 *Loesch, P. J. & Zuber, M. S. Differences in amylose content in maize due to gene dosage effects associated with endosperm tissue.* (*p. 50*).
Estimates of general and specific combining ability and of reciprocal effects were obtained from a diallel-crossing system consisting of one set of F_1 single crosses and reciprocals. The five parents ranged in amylose content from 62 to 70%; each parent was undergoing conversion to a high-amylose line. Amylose determinations were made on the F_1 seed produced on parental plants; parents were not included in the statistical analysis. Highly significant differences were found in general combining ability. Differences in specific combining ability were not significant. Disparities in amylose content attributable to the direction of the cross were highly significant. It is suggested that differences in maternal and paternal influence on amylose content are primarily due to gene-dosage effects associated with the endosperm.

1494 *Lunden, A. O. & Wallace, A. T. Inducing mutations in vegetative tissue of barley with ultraviolet light.* (*p. 51*).
The terminal apices in dormant and hydrated seeds were exposed by dissecting away all overlying tissues, including one foliage leaf. The percentages of mature-plant survival for apices of control samples and irradiated apices were respectively about 50% and 45%. Of the 1791 progenies raised from the treated material, 0·7% segregated for chlorophyll deficiencies; no such deficiencies were observed in 381 control progenies. Nearly all the deficiencies involved chimeral sectoring.

1495 *McBride, A. C. & Zuber, M. S. The effects of plant density on several yield components for the parents, F_1 and F_2 generations of hybrid grain sorghum.* (*p. 51*).
In a study of four hybrids, population densities of 36,000 and 18,000 plants per acre were used. The lower density resulted in reduced yields in all generations. The F_1 outyielded the F_2 at both densities. This difference in yield was associated with more seed per head and not with average weight per seed. Average seed weight of both the F_1 and F_2 was however greater than in the parents. The difference in yield between the F_1 and F_2 was about the same for the two rates of cultivation. Density did not affect threshing percentage or number of days from sowing to flowering. The F_1 and F_2, however, flowered earlier than the parents. With the higher rate, plants were taller. Heritability estimates were obtained for plant height and weight per head.

1496 *Miller, D. A. & Hittle, C. N. A study of chemical induction of gamete sterility in alfalfa.* (*p. 51*).
According to data on seed set, spraying with sodium 2,3-dichloroisobutyrate at the early-bud and early-anthesis stages had a stimulatory

effect on ♀ and ♂ fertility at low concentrations but an inhibitory effect at higher concentrations.

1497 *Nielsen, E. L. Analogies between genetical and cytological behaviors in wide crosses and male-cytoplasmic sterility in crop plants.* (*p. 51*).

Data have been recorded on sterility, anther abortion and microsporocyte degeneration at prophase in wide crosses in the Gramineae and other families. Degeneration during prophase is associated with extrusion of pycnotic material from the nucleus in the form of droplets or globules, which may represent polymerized DNA, RNA and aminoacids or proteins. Similar phenomena have been induced by treatment with ribonuclease, which has caused the production of abnormal achromatic figures characterized by unequal disjunction, bridges, stickiness, globule formation and pycnosis. Assuming the effects of artificial treatments to be analogous to those observed in wide crosses, it is postulated that cytoplasmic ♂ sterility in certain crop plants may be the outcome of disharmony between enzyme-protein systems in the cytoplasm.

1498 *Owen, C. R. Performance of six component clonal lines of white clover, the Syn 2 from them, and clones from the Syn 1.* (*p. 51*).

Data are reported for the component clonal lines and their polycross progenies, results for the Syn. 2 and for clones from the Syn. 1 not being yet available. The clonal lines were isolated from stocks acclimatized in Louisiana. Polycross observations revealed significant differences between lines in forage yield, stolon spread, seed yield and frequency of heads at the flowering stage on 15 April. The latter frequency was positively and significantly correlated with seed production. Differences between clones in dry-matter content, floret number per head and percentage of fertile florets were not significant.

1499 *Rasmusson, D. C. & Lambert, J. W. Variety x environment interactions in barley variety tests.* (*p. 52*).

Data on six varieties tested for a four-year period in eight localities in Minnesota were analysed. A highly significant variety x year x location interaction was obtained. The variety x location variance component was not significant. The variety x year interaction was significant. The results indicated that use of several trial centres in one year would not be of equal value to testing in different years.

1500 *Rawlings, J. O. & Cockerham, C. C. Genetic information from double-cross hybrid populations.* (*p. 52*).

"The purpose of this study was to determine the genetic information available from an analysis of variance of double-cross hybrid populations. The analysis of variance is of the complete set of double-crosses from a set of lines. The lines are assumed to be a random sample of lines with arbitrary but equal inbreeding with reference to some non-inbred population. The genetic interpretations of the analysis are in terms of components of variance for the non-inbred population. Various hypotheses concerning the type of gene action may be tested, some of which are concerned only with epistasis. The most powerful tests are, in descending order of power, of the hypotheses of (1) no genetic variance, (2) no dominance or epistatic genetic variance and (3) no epistatic genetic variance except the two factor additive x additive epistatic variance. Several different combinations of components of genetic variance or functions of components of genetic variance may be estimated, depending on the type of gene action assumed. For example, assuming no epistatic interactions involving more than two loci, additive, dominance and each of the three two-factor epistatic components of genetic variance can be estimated from this analysis."

1501 *Reitz, L. P. & Briggle, L. W. Wheat survey reveals major shifts to new varieties.* (*p. 52*).

Attention is drawn to some changes in the commercial importance of wheat varieties in the USA, as revealed by a survey in 1959.

1502 *Richards, H. R., Patterson, F. L. & Schafer, J. F. Inheritance and expression of loose smut resistance in wheat.* (*p. 52*).

A report is given on investigations still proceeding at Purdue University on the genetics of loose-smut resistance in crosses between several resistant and susceptible varieties. Races 6 and 11 were used for inoculation. Resistance to race 6 has proved to be recessive and resistance to race 11 dominant. Further genetic analysis awaits the collection of the necessary data.

1503 *Robinson, H. F. & Cockerham, C. C. Heterosis and inbreeding depressions in populations derived from open-pollinated varieties of maize.* (*p. 52*).

Performance with different degrees of heterozygosity is one source of evidence on the magnitude of epistasis in a population. The regression of mean performance on heterozygosity level may be interpreted relative to the nature of gene action and, particularly, the effects of epistasis. The open-pollinated varieties Jarvis and Indian Chief and the cross between them were allowed to breed randomly or selfed to produce the desired degrees of heterozygosity. Heterosis in the cross and inbreeding depression were examined with respect to the nature of the genetic diversity in the varieties. Data on yield provided little evidence of important epistatic action, since in general performance and degrees of heterozygosity were linearly related. Heterosis in the intervarietal cross, it is suggested, is the consequence of differences in gene frequencies in the parents, which were shown to contain a preponderance of heterozygous loci.

1504 *Sentz, J. C., Gates, C. E. & Rinke, E. H. Diallel crosses among constituent lines for evaluating a synthetic maize variety.* (*p. 53*).

Diallel crosses among eight lines constituting a synthetic were evaluated in the F_1 and S_1 (F_1 selfed) generations at two centres in southern Minnesota during 1958 and 1959. These lines were chosen as parents for their agronomic characteristics and specific combining ability. Data were recorded on grain yield, maturity and root and stalk lodging. The analytical procedure followed that used by Rojas and Sprague [cf. XXIII, 1140]. Variance for general combining ability in yield was several times greater than that for specific combining ability in both generations. General combining ability x year x location variance was the only important interaction. Comparison of genetic variances in both generations demonstrated the utility of S_1s in diallel experiments. The validity of the estimates of general and specific combining ability for evaluating genetic parameters of the synthetic is to be ascertained from studies in progress on variability in the synthetic.

1505 *Shands, H. L. Multiple crosses of oats.* (*p. 53*).

A quintuple cross was made by convergent hybridization of 31 varieties and selections. The 15 named varieties and 16 other selections, mostly of hybrid origin, were chosen on the basis of possessing general or specific characters which might be incorporated into new varieties for Wisconsin and possibly elsewhere. Some information was available on the varieties as regards adaptation, yield and agronomic and disease reactions, but little could be predicted as to progeny type. An attempt was made to have in each group of four parents representatives of differing sources of genes for disease resistance and other characters. Eight double, four triple and two quadruple crosses and the final quintuple cross were effected. The first quadruple cross involved 16 better-known varieties and promising selections, while the second had one well-known variety and 15 less well-known varieties and selections in its parentage. F_3 seed of the quadruple and quintuple crosses was obtained in 1959.

1506 *Singh, A. P. & Blackmon, C. R. Effectiveness of hand vs. scissors emasculation and different aged pollen in wheat hybridization.* (*p. 53*).

Anthers in some flowers of Weibull 4808 and Frondoso were removed before anthesis by hand, while in others they were cut off with scissors along with the portions of the lemma and palea. In some of the florets a greater portion of the style along with the anthers was removed by scissor emasculation than by hand. Scissor emasculation proved to be effective, and in Frondoso a somewhat higher percentage seed set was obtained by scissor emasculation. In fertilizing cut florets, dehisced pollen was more effective than mature but nondehisced pollen.

1507 *Smith, D. C. Long-time seasonal effects on varietal responses of Sudangrass in developing cyanogenetic glycoside.* (*p. 53*).

In testing for HCN content at the Wisconsin Agricultural Experiment Station, the short qualitative method based on colour change in filter paper saturated with sodium picrate solution and visual comparison with standards has been applied. In general, varieties have maintained their relative positions for HCN content from year to year. Tift and Sweet Sudan are potentially high in HCN production, while Piper is relatively low. Other varieties tested were intermediate.

1508 *Sonnemaker, E. H. & Alexander, D. E. Inbreeding depression in autotetraploid maize.* (*pp. 53–54*).

Loss in vigour from the F_1 to F_2 was determined in 40 autotetraploid hybrids developed by means of the method utilizing gene *el* [cf. 1461]. Data were collected on yield and four other characters. Loss in yield between the F_1 and F_2 was con-considerably larger than expected. On the average, F_2 yields were reduced 30·2% below F_1 yields, a decrease of only 3·7–6·3% having been expected. Possible explanations of this discrepancy are: (1) the inbreds entering into the hybrids were not homozygous, (2) inbreeding brought about an increase in the frequency of aneuploidy and thus an increase in seed abortion, and (3) the duplex condition is optimum for heterosis.

1509 *Stanford, E. H. Transference of a gene for seedcoat color from diploid to tetraploid alfalfa. (p. 54).*

A diploid lucerne (FC31484) introduced from Alaska and studied at the University of California showed considerable variation in seed-coat colour. An individual having a dark-purple seed-coat was crossed with a 4*x* plant of *Medicago sativa* with greenish-yellow seed-coat. Three back crosses were made with normal *M. sativa*, F_1 plants with a dark seed coat being selected in each generation. S_1 and S_2 progenies were produced after the three back crosses and classified. Dark seed coat was controlled by a single major gene inherited tetrasomically. The F_1 plants of the original cross and of each back cross were vigorous and fertile. The S_1 and S_2 contained many aberrant types and selfed seed set was poor.

1510 *Starnes, W. J. & Hadley, H. H. The effect of α,β-dichloroisobutyrate on soybeans. (p. 54).*

Applied 3 weeks after planting to four varieties, α, β-dichloroisobutyrate appeared to be more effective as a gametocide by virtue of its interference with anther dehiscence than as a result of its causing pollen abortion. Its effects on pollen and anthers did not result in an increase in outcrossing because of the extreme amount of cleistogamy in the treated plants. Ford and Lincoln were less severely affected than Adams and Dunfield.

1511 *Suneson, C. A. & Wiebe, G. A. Material and a breeding method promising better barleys for everyone. (p. 54).*

The 6200 spring barleys in a world collection were bulked and randomly recombined with diversely maturing male-sterile plants grown in alternate rows in California. The F_1 seed thus produced by the latter is offered to breeders throughout the world. This programme is designed to promote wider use of the "evolutionary" method of breeding and to achieve a more dynamic management and distribution of the world's resources in barley germ plasm, these aims being prompted by experience with complex populations under competitive natural selection. The diversity of the population offered should make it universally useful as initial material. Recombination will continue with male-sterile segregates for 10–15 generations.

1512 *Thomas, J. P. & Zuber, M. S. The effect of various mechanical mixtures of waxy and normal kernels on high-amylose corn. (p. 54).*

A problem which will confront both producer and breeder of the high-amylose type is that of contamination from normal or low-amylose maize through mechanical mixing during harvest, transportation and storage or genetic mixing during pollination. Mechanical mixtures were therefore analysed with respect to the effect on amylose content, 30-kernel samples with various proportions of waxy (no amylose) and high-amylose (65%) kernels being used. For each unit increase in the number of waxy kernels amylose percentage decreased by about 2%. With an error of ± 2% in the chemical analysis, it would not be possible to detect contamination involving less than 2 kernels out of 30. Protein content of the endosperm, weight of pericarp + germ and endosperm weight were also determined. Regression was linear in all cases, with each unit increase in the number of waxy kernels giving higher endosperm and pericarp + germ weights and lower protein percentage. Analyses of mechanical mixtures of normal and high-amylose maize and genetic mixtures of high-amylose lines differing in amylose content are in progress.

1513 *Thompson, D. L. & Harvey, P. H. Progress from recurrent and reciprocal recurrent selection for yield of corn. (pp. 54–55).*

Synthetic A, constituted from three synthetic varieties, was used as the initial material for recurrent selection. Top-cross yield tests were conducted for five cycles of selection. The variety Jarvis was the tester for the first cycle and the single cross NC7 x CI21 the tester for the other four cycles; the double cross NC27 and single-cross tester NC7 and CI21 served as controls. Mean yields of top crosses expressed as percentages of the controls were 77·8, 86·0, 94·2, 96·7 and 98·8% for cycle 1, 2, 3, 4 and 5 respectively. Synthetic A and Synthetic G were used as initial material for reciprocal recurrent selection, the latter being constituted from four white and four yellow inbreds. Top-cross yield tests were carried out on three cycles, the controls being Dixie 17, NC27, NC7 x CI21 and T13 x T61. For Synthetic A, mean yields of top crosses expressed as percentages of the controls were respectively 82·7, 89·1 and 94·6% for cycle 1, 2 and 3. Corresponding percentages for Synthetic G were 82·2, 82·9 and 93·3%. [Cf. XXX, 3698].

1514 *Waddle, B. A. The inheritance of minute hilum in soybeans. (p. 55).*

Plants with a very small hilum appeared in F_2 Lincoln x Purdue Acc. 2300–2. Hilum size was governed by a single pair of genes, the normal type (*Mi*) as found in Lincoln being completely dominant to the small hilum (*mi*) characteristic of the second parent. Minute hilum was independent of flower colour (*W*), pubescence colour (*T*), hilum colour (R_1), pod colour (*L*) and growth type (*Dt*). When incorporated in plants with grey pubescence, dark hilum and purple flowers ($tt\ r_1r_1$ WW), *mimi* resulted in a black hilum instead of the usual imperfectly black one found in this genotype.

1515 *Zimmerman, L. H., Brigham, R. D., Culp, T. W., Smith, J. D. & Vaccaro, J. W. Breeding and performance of dwarf-internode F_1 castorbean hybrids. (p. 55).*

The sex characters required for commercial production of F_1 hybrids have been fixed in inbreds with shortened internodes. Preliminary yield tests have suggested that dwarf-internode inbreds are of potential economic value. In the Texas High Plains, the most productive dwarf-internode F_1 hybrids yielded 19% more than the dwarf-internode inbred Baker 296, the most widely-grown commercial variety in that area. In California, where commercial normal-internode F_1 hybrids have outyielded dwarf-internode inbreds by about 20%, the yields of only 3 out of the 27 dwarf-internode F_1 hybrids tested were significantly lower than those of the commercial normal-internode F_1 hybrid used as control. Plant height of the dwarf-internode hybrids ranged from 50 to 80% of that of the control hybrid. No association has been found between height and yield.

1516 *Cherry, J. H. & Hageman, R. H. The acid-soluble nucleotides and ribonucleic acid of different strains of corn. (p. 56).*

Compared with its parental inbreds, hybrid WF9 x M14 had a higher quantity of nucleotides in the embryo and also a higher content of RNA in the scutellum and embryo. Nucleotide content in the scutellum of WF9 x M14 was intermediate between the values for WF9 and M14. Ion-exchange chromatography on Dowex-1X8 demonstrated qualitative and quantitative differences between hybrids in nucleotides. Normal hybrids had a lower content of nucleotides than dwarf ones.

1517 *Gorz, H. J. & Haskins, F. A. Translocation of coumarin across a graft union in sweetclover. (p. 57).*

Investigations on graft combinations of plants differing with respect to the coumarin-determining gene pairs *Cucu* and *Bb* provided support for the hypothesis that synthesis of coumarin occurs primarily in the leaves and that a small amount is translocated to the stems and roots.

1518 *Mays, D. A., Washko, J. B. & Bratzler, J. W. A comparison of Pa. 602 hybrid corn and its brachytic–2 dwarf counterpart E.S. 602 for silage purposes. (p. 65).*

On the average of five experiments in Pennsylvania, Pa. 602 yielded 15·5% more dry matter than the dwarf hybrid ES602BR2. Percentages of stalk and leaf were respectively 27 and 19 in Pa. 602 and 22 and 25 in the dwarf hybrid. Percentages of husk and ear were similar in the two hybrids. Stage of maturity at sampling time had a greater influence on plant composition than variety, in that the ears increased in size until they constituted about 54% of the entire plant in both hybrids, while the other components were proportionately reduced. ES602BR2 had 1% more protein and 1·5% more fibre than Pa. 602, and was slightly lower in total digestible nutrients. In both hybrids, protein and fibre content decreased and total digestible nutrients increased as they matured. As determined in sheep-feeding trials, digestibility and energy values for silage made from the two hybrids were similar.

1519 *Webster, O. J. A comparison of yields, dry-matter and protein contents of fertile and sterile forage sorghum harvested weekly from full bloom to maturity. (p. 66).*

The results of trials carried out on F_1 hybrids in 1957 and 1959 at Lincoln, Nebr., are summarized.

1520 *Long, J. A. & Bashaw, E. C. Cytology, reproduction and breeding behavior in St. Augustinegrass. (p. 70).*

Types of the turf species *Stenotaphrum secundatum* with yellow stigmas were diploid ($2n = 18$). Four purple-stigma types had 27 and one purple-stigma type 36 chromosomes. Cytological examination showed that the diploid types underwent normal sexual reproduction. The triploids were highly sterile and varied considerably in meiotic behaviour. The 36-chromosome type was relatively normal meiotically and highly sterile.

1521 *Powers, L. The partitioning method of genetic analysis applied to sugar beet breeding.* (*p.* 72).

Attention is drawn to the value of the partitioning method in sugar-beet breeding, as indicated by its application in analysing weight per root, to frequency distributions in the synthetic A54–1 and to the progeny means of mother-line selections made from a polycross test [cf. XXIX, 2918–19].

1522 *Johnson, R. T. Studies on interspecific hybrids within the genus, Beta.* (*pp.* 72–73).

At Spreckels Sugar Company, three approaches are being used in an attempt to transfer disease and pest resistance to *B. vulgaris* from species belonging to sect. *Patellares*: (1) grafting young F_1 seedlings from interspecific crosses on sugar-beet rootstocks, (2) making a bridge hybrid, i.e., crossing *B. maritima* with *B. procumbens* and then crossing the F_1 to *B. vulgaris*, followed by further back crossing, and (3) synthesizing polyploids of *B. vulgaris* and members of sect. *Patellares*, for use in crossing.

1523 *Owen, F. V. Cytoplasmic and Mendelian male sterility for hybridization of sugar beets.* (*p.* 73).

The possibilities of exploiting the above two types of male sterility in the production of F_1 sugar-beet hybrids are outlined. With Mendelian male sterility, only 25% pollen-aborted segregates (*aa*) appear in the F_2 and 50% in back crosses. The gene *a* is useful to the breeder in developing foundation stocks and producing pollinators in four-way commercial hybrids of the type (A x B) x (C *aa* x D), in which A and A x B carry cytoplasmic sterility. At the USDA Sugar Beet Field Laboratory, Salt Lake City, curly-top resistant inbreds carrying a "special gene for self fertility" have been developed. Some of these lines, both monogerm and multigerm, appear to have promise as parents of commercial hybrids. Annual beets have been introduced in the breeding programme because of their value in facilitating certain types of indexing procedures.

1524 *Finkner, R. E. & Doxtator, C. W. Breeding for suitable chemical constituents in the sugar beet.* (*p.* 73).

Recent developments in the USA in the improvement of processing quality are considered [cf. XXX, 4160].

1525 *Hanson, C. H.* et al. *The relative performance of variety crosses, variety mixtures, and their respective parents in alfalfa.* (*p.* 75).

Fifteen variety crosses, 11 variety mixtures and 10 varieties were planted in 9 states. The first year's data, obtained in 8 states during 1959, provided no evidence of heterosis in the performance of the crosses. The slightly better performance of the crosses and mixtures over the average of the parents was explained on the basis that "the more vigorous plants predominate in a broadcast stand and therefore an overall performance greater than the expected average for individual plants in that stand results."

Proceedings of Plant Science Seminar, Camden, New Jersey 1960 : Pp. 162.

1526 *Holmes, F. O. Control of important viral diseases of tomatoes by the development of resistant varieties.* (*pp.* 1–17).

Sources of resistance to the tobacco mosaic, spotted wilt, sugar-beet curly-top and tobacco-etch viruses are discussed in this review. Virus diseases for which no resistance has yet been developed are surveyed. Reference is made to recent developments in the use of single-gene resistance for the identification of viruses. In the discussion which followed presentation of this paper, reference was made to TI245 tobacco, a line which has shown resistance to all viruses thus far applied to it.

1527 *Hoadley, A. D. The development of anthracnose resistant tomatoes.* (*pp.* 19–36).

In large-scale field tests, aluminium foil envelopes provided conditions which induced consistently high levels of anthracnose infection on detached, artificially inoculated, susceptible fruit. Varietal reaction to the disease in tests using these envelopes was comparable to the reaction under conditions of natural infection. A selection of *Lycopersicon esculentum* var. *cerasiforme* was used as the resistant parent in crosses with large-fruited varieties. One of the processing-type lines developed, AC629, possesses a moderate level of resistance to anthracnose (*Colletotrichum atramentarium*). The line has not been released, however, as it is susceptible to *Fusarium* wilt and does not possess a high level of resistance to fruit cracking.

Evidence is presented which suggests a complex mode of inheritance for resistance to anthracnose. Resistance was not transmitted to the F_1 of resistant x susceptible crosses. Defoliation and fruit production period are discussed with reference to their influence on levels of resistance. The importance of evaluating the physiological factors which influence susceptibility is emphasized.

1528 *Ludwig, R. A. Host pathogen relationships with the tomato anthracnose disease. (pp. 37–56).*

Because of similarities in behaviour in spore germination, the infection process and the physiology of disease development, *Colletotrichum atramentarium* may, it is suggested, be a strain of *C. gloeosporioides* (*Glomerella cingulata*).

1529 *Harrison, A. L. Breeding of disease resistant tomatoes with special emphasis on resistance to nematodes. (pp. 57–78).*

Developments in the breeding of tomatoes resistant to *Fusarium oxysporum* f. *lycopersici*, *Alternaria solani*, *Stemphylium solani* and *Meloidogyne* ssp. are reviewed. Particular attention is paid to the possibilities of breeding for multiple disease resistance.

1530 *Beadle, G. W. The chemical basis of modern genetics. (pp. 79–92).*

Current concepts of the role of the nucleic acids in genetic processes are explained.

1531 *Reynard, G. B. Breeding tomatoes for resistance to fruit cracking. (pp. 93–112).*

Methods of testing for crack resistance and fruit firmness, sources of crack resistance, and inheritance and linkage studies on the genes involved, are reviewed. It is affirmed (in the discussion) that radial crack resistance and concentric crack resistance are apparently governed by separate gene systems.

The breeding programme at Riverton, NJ, which led to the release of two crack-resistant varieties, 135 and 146, is outlined. The former is a main-season variety with its peak picking time slightly later than that of Improved Garden State. The foliage is susceptible to *Alternaria* and to *Stemphylium* leaf spot. Resistance to both radial and concentric cracking is high.

The season of maturity of 146 is close to that of Rutgers. The variety is highly resistant to *Fusarium* wilt and has shown resistance to *Stemphylium* in seedling tests and under field conditions. It is more tolerant of tobacco mosaic than either Improved Garden State or Rutgers. The fruit is moderately resistant to radial and concentric cracking, but is susceptible to blossom-end rot.

Both varieties yielded as well as standard varieties in 1955–1957 trials in New Jersey. Commercial experience in 1958–1959 indicated that both are suitable for canning purposes.

1532 *Gallegly, M. E. Resistance to the late blight fungus in tomato. (pp. 113–35).*

Among the topics discussed in this review are the sources and mechanisms of resistance to *Phytophthora infestans* and the origin and significance of physiological specialization by the pathogen. The relative value of monogenic and multigenic resistance to the disease is compared.

1533 *Porter, D. R. Quality criteria and their evaluation in a breeding program for processing type tomatoes. (pp. 137–50).*

Data are presented which demonstrate that tomato varieties differ in the following characteristics: quality of red colour; prevalence of fruit diseases and defects, which can affect the cost of preparation for processing; flavour of the product after processing; and pH level, an important factor during canning. Many tomato varieties released for canning purposes fail to reach the required quality standards. It is suggested that all new lines be critically evaluated before release.

1534 *Parker, M. W. Important problems that plant breeders need to solve. (pp. 151–57).*

Particular emphasis is laid on the inadequacy of current knowledge of statistical genetics for the solution of major plant breeding problems. Further information on the genetic control of biochemical processes is required to increase the efficiency of programmes designed to improve chemical quality in crop plants. Resistance of crop varieties to agricultural chemicals, the need to improve evaluation procedures in breeding and the mechanism of cytoplasmic sterility are amongst other outstanding problems that require further study.

1535 **Advancing agriculture through research. Seventy-second annual report 1958-1959.**
Bull. Md. agric. Exp. Sta. 1960 : No. A–109 : Pp. 78.

Maize. Promising results were shown by a dwarf version of the hybrid Pa. 602.

Sorghum. Hybrid lines of grain sorghum outyielded nonhybrid varieties in 1958 trials.

Millet. Varietal tests involving millets and Sudan grasses revealed a great diversity among varieties in yielding ability, aftermath production, date of flowering, plant height, stalk diameter, leafiness and resistance to leaf diseases. Gahi–1 pearl millet was very promising. Several new Sudan grasses were superior to Tift and Piper in disease resistance.

Tobacco. The varieties Mor 59 and Mor 609A are described briefly; both are resistant to black shank (*Phytophthora parasitica* var. *nicotianae*) and *Fusarium* wilt.

Pepper. New experimental lines, free from genetic variation, have been produced by doubling the chromosome number of haploids with colchicine. One doubled haploid line, G168A, yielded a high proportion (about 3%) of twin seedlings with haploid members. This line was used in reciprocal crosses with a line characterized by a low frequency of twin seedlings in order to determine the effects of the genotypes of the male and female parents on haploidy. The two parental lines differed in inherited fruit characters which permitted the determination of the origin of the haploids. Analysis of the cross in which G168A was used as the female parent indicated that "the pollen parent did not affect the frequency of haploids from twin seedlings. All 123 haploids classified had fruits like the female parent; thus their inheritance was obtained from the female parent only."

Soya bean. The variety Hood is described [cf. XXIX, 2059].

1536 **Research Reports of the Virginia Agricultural Experiment Station for the periods July 1, 1953, to June 30, 1957** : Pp. 277; **and July 1, 1957, to June 30, 1959** (1960) : Pp. 290.

In addition to the results reported below, information is provided on varietal trials involving a wide range of field, vegetable and fruit crops.

Cereals. Further progress has been made at the Blacksburg and Warsaw stations in breeding improved, disease-resistant varieties of wheat, barley and oats.

A synthetic developed from crosses between southern and corn-belt maize continues to be very promising. Other synthetics, incorporating germ plasm from Mexico, the Caribbean area and South America, are being developed in an attempt to utilize desirable traits such as disease resistance, lodging resistance, yield and other favourable characters. Synthetics to be used as sources of breeding material for dwarf hybrids, low-eared and long-eared hybrids and hybrids with two or more ears per plant are also being developed. Progress is reported in the development of inbred lines and hybrids with a high content of both oil and protein.

A study to determine the distribution of genes for resistance to leaf rust in barley is in progress. It has been found that each of the varieties Sudan, Speciale, Oderbrucker, Lechtaler, Reka and Gold has a single gene conditioning resistance to race 4 of the pathogen. The genes in the first three of these varieties are identical but the genes in the other three varieties are different. Bolivia and Quinn have two genes, one of which is the same gene as that found in Reka.

New varieties of hybrid sorghum, all of the dwarf combine type, outyielded the open-pollinated varieties Plainsman and Martin by 30% or more.

Cocksfoot. Two studies involving 96 phenotypes showed that morphological characters influenced persistence and yield. Large-leaved types with a prostrate growth habit were more aggressive towards Ladino white clover and lucerne than were erect, fine-leaved types. An extensive breeding programme is in progress and selected lines and crosses are being evaluated.

Lucerne. Varieties which showed some resistance to an attack of southern anthracnose (*Colletotrichum trifolii*) were Williamsburg, Atlantic, Kansas Common and several breeding lines.

Red clover. Kenland was the most resistant of 13 varieties to southern anthracnose.

Birdsfoot trefoil. Over 100,000 seedlings were screened in the greenhouse for resistance to *Rhizoctonia* foliage blight. Selections with varying degrees of resistance have now been made and are undergoing further evaluation.

Tobacco. Progress is reported in the development of improved varieties with resistance to such diseases as mosaic root rot, black shank (*Phytophthora parasitica* var. *nicotianae*), wildfire (*Pseudomonas tabaci*), and root knot (*Meloidogyne* spp). Virginia 312, a dark fire-cured tobacco with resistance to mosaic root rot, is described [cf. XXVIII, 4538]. An improved greenhouse technique for evaluating resistance to black shank is outlined.

Apple. A large number of crosses, involving standard varieties and breeding lines, have been made and progenies from these crosses are undergoing selection. Qualitative and quantitative criteria used in selection are listed. Among crosses that have given promising seedlings are Albemarle Pippin x Golden Delicious, Rome Beauty x Starking, Minjon x York Imperial, Macoun x Arkansas Black, Macoun x

Yorking, Jonared x VPI1095, Idared x VPI1116, crosses between Winesap and Rome Beauty, York Imperial, Jonathan and Starking and crosses of McIntosh with Rome Beauty, Gallia Beauty and Jonathan.

Peach. The varieties Washington [cf. XXX, 3116] and Jefferson are described briefly. Four clingstone selections have shown superior canning qualities and are undergoing further testing.

Nectarine. Lexington [cf. XXIX, 4321] and Redbud [XXIX, 4321] are described.

Groundnut. Virginia 56R, released in 1957, is described briefly. A large number of lines of this variety are being used in a study designed to determine if certain constituents, such as free aminoacids, can be correlated with resistance to specific insect pests.

Raspberry. A number of selections, which appear to be adapted to the climatic conditions of Virginia, are undergoing further testing. They include VPI4, a very early red raspberry which bears a crop of berries on the current season's growth of canes in addition to the crop produced on canes of the preceding season's growth.

Musk melon. Lines of *Cucumis melo* resistant to powdery mildew (*Erysiphe cichoracearum*) were crossed with the susceptible variety Ambrosia. Two selections derived from this cross have shown good resistance to the disease and are acceptable as regards quality.

Beans. Nemagreen, a nematode-resistant bush Lima bean, is described [XXVI, 3923].

Soya bean. Reference is made to Lee [XXIV, 3843], Hood [XXIX, 2059] and Hill [XXX, 2076], three varieties released in the past few years.

Sweet corn. Environmental and botanical factors influencing quality characteristics have been studied. It has been shown that the pollen of certain maize-like varieties can markedly influence important quality characteristics in sweet corn.

1537 Scott, F. H. & Johnson, L. W.
1959 progress report. Variety trials. Tomato, sweet potato, pepper.
Res. Rep. Va. agric. Exp. Sta. 1960 : No. 34 : Pp. 33.

A detailed report is given on the results of the above trials.

1538 **Annual Report of Agricultural Experiment Stations, University of Florida, for the fiscal year ending June 30, 1959** : Pp. 415.

Biochemical genetics. The growth requirements of mutants of *Arabidopsis thaliana* are now being investigated in an attempt to find tryptophane-requiring mutants [cf. XXX, 2360].

Oats. Late-maturing lines were found, in general, to give higher forage yields than earlier lines. This was noted in a trial in which 41 advanced breeding lines were tested for grain and forage production in comparison with Seminole and Floriland. Certain lines exhibited a degree of tolerance to a severe crown-rust epidemic, primarily caused by race 290. Ten varieties were used in a study of the relationship between grain yield of a normally sown population and the mean grain yield of a number of space-planted individuals from that population. An analysis of the data indicated that the yield of normally sown populations is largely influenced by the following factors, either alone or in combination: (1) the interaction of a group of biotypes; and (2) the competitive ability of certain biotypes present in the population in a relatively low frequency. The first factor, it is suggested, would be more influential, since natural selection over a series of generations would tend to eliminate all but the most competitive biotypes from a given population. Data from varietal mixtures indicated that the yield of the mixtures was not controlled by the proportion or yielding ability of the varieties present in the mixture.

At the North Florida Branch Station, all entries in 1958–1959 yield trials were heavily infected with crown rust race 290 except derivatives of crosses involving Trispernia, DLM3, CI7172, and selections derived from irradiated Floriland. Approximately 1600 lines were tested for seedling reaction to crown-rust races 203, 216, 264 and 290 and stem rust. A number of lines showed combined resistance to all these races. AB180, an irradiated Floriland selection, is undergoing multiplication; it is uniform in type and has shown high resistance to the Landhafer races of crown rust.

Investigations have commenced to determine what modifying factors can be used to increase γ-radiation mutation effects in higher plants. In a study of irradiation effects on oat grains with different moisture contents, it was found that the highest mutation rate may be expected from seeds with a moisture content of 9·6%. Other work has been initiated on factors influencing the induction of mutations by ultraviolet rays.

Maize. Studies on the evaluation of different maize-breeding methods have continued. The results of a 3-cycle selection trial have indicated that a specific tester, such as an inbred line or a single cross, may be more effective than a general tester in developing high-yielding hybrid combinations.

A number of varieties have been selected at the Everglades Station for resistance to northern leaf blight.

Forage grasses. Pearl-millet plants were crossed with Napier grass, the main objective being to produce a Napier-type grass with some of the good forage qualities of millet. The better hybrids resulting from this cross are now under observation. Over 150 collections of *Digitaria* are being grown, the objective being to identify superior genetic material for incorporation into a breeding programme.

White clover. Twenty-six clones have been selected on the basis of summer persistence and satisfactory autumn growth. Continued selection is now under way in a polycross nursery.

Lupin. Inheritance studies of resistance to *Stemphylium solani* in blue lupins are continuing.

Kenaf. Reciprocal back crosses of amphidiploid (*Hibiscus cannabinus* x *H. eetveldeanus*) to *H. cannabinus* have been made in an attempt to obtain resistance to nematodes.

Sansevieria. Back-cross clones of (*S. trifasciata* x *S. deserti*) x *S. trifasciata* contained more fibre than the parents or the F_1 hybrids.

Tobacco. Among lines which have shown high resistance to nematodes as well as high yield and satisfactory quality are 22–2, 7107, 417A, 525, 214I, 5–31, 5–57 and 5–53. Breeding is being continued to introduce higher resistance to black shank, blue mould and nematode diseases in cigar-wrapper tobacco. Lines satisfying the current demand for a slightly smaller leaf than in Dixie Shade have been obtained by crossing unspecified Florida and Connecticut varieties.

Peach. A superior selection, 4–26, which combines excellent size, shape and colour and is early enough to be economically satisfactory is being multiplied.

Citrus. Some resistance to the burrowing nematode has been observed in cuttings of *Citropsis gilletiana.* Budding and grafting studies have indicated that this species is compatible with citrus.

Mango. Data are provided on the yield, percentage of perfect flowers, fruit set and time to harvest of a number of varieties in the collection at the Subtropical Station.

Groundnut. A newly-bred line, 319–12, has excelled in yield of nuts but their quality is less satisfactory. A number of crosses have been made, the major aim being to increase seed quality as well as freedom from concealed damage.

Rubus. The variety Flordagrand has been released. A number of selections from Regal Ness x *R. trivialis* and Regal Ness x *R. cuneifolius* have compared favourably in both field behaviour and quality tests with Flordagrand. Seedlings for further selection and breeding have been obtained from crosses between genetically thornless varieties and selected thorny types.

Blueberry. The best seedlings of northern highbush blueberry x *Vaccinium darrowi* have been crossed with the northern highbush blueberry.

Strawberry. An attempt is being made to select early-fruiting seedlings within a line derived from a Fla–45 x Albritton cross.

Grape. Selections 1147 and 716 are being increased for possible release [cf. XXIX, 241]. Twenty-eight hybrids, selected from a nursery with 458 lines, are highly resistant to downy mildew, anthracnose and black rot. Several of these selections are, in addition, early and have fruit of excellent quality.

Celery. Breeding for resistance to *Cercospora apii* and for other characteristics has continued.

Cantaloupe. The variety Florida 57 is now ready for release. A number of other selections, including Florida 1, Florida 8 and Honeydew Mo 2 have shown some favourable characteristics although flavour is insipid and the leaves were badly damaged by downy mildew, *Alternaria* and gummy stem blight.

Water melon. In a 7-variety trial, high yields and moderate to high resistance to *Fusarium* wilt were shown by Charleston Gray, 51–23B and Summit.

Tomato. In trials at the Indian River Station, best results were obtained from STEP–305, STEP–314 and Indian River. Indian River was released in 1959 and it is expected that the two STEP varieties will be released in 1960. Selections from PI117897 and PI128887, which are resistant to three strains of potato virus Y, have been found to be susceptible to a locally collected isolate of the virus, Y4. Homestead 24 and some other varieties have been crossed and back crossed with accessions possessing resistance to *Verticillium* wilt at the Subtropical and Gulf Coast Stations. In varietal trials at the latter station, the outstanding entries were three STEP lines, 281, 305 and 314 and three unspecified GCS lines. At the North Florida Station, the best STEP lines were 278, 311 and 314, while other outstanding varieties were Rutgers and Homestead 24.

Lima bean. Collections of *Phaseolus coccineus, P. polyanthus, P. ritensis, P. dumosus, P. aborigineus* and *P. caracalla* have been assembled for possible future introduction into breeding programmes. The cross *P. polystachus* x *P. lunatus* 'Fordhook' has yielded two vigorous F_1 hybrids, which have been successfully back crossed with Fordhook.

Soya bean. Genetic studies have been conducted on the mode of inheritance of various qualitative characters with particular emphasis on their linkage relationship. Two linkages previously reported by other investigators were confirmed, namely, *Gg* (seed coat colour) with D_1d_1 (cotyledon colour), and *Dtdt* (growth type) with L_1l_1 (pod wall colour). The investigations have yielded strong evidence that *Gg*, D_1d_1, *Dtdt* and L_1l_1 are all in the same linkage group. A further linkage group containing D_2d_2 (cotyledon colour), *Pdpd* (pubescence type) and $i^i i$ (seed coat colour) has also been identified.

Of 184 varieties planted at Fort Lauderdale in February, the varieties F55–106, F55–178 and F57–384 were outstanding. At the Subtropical Station, F57–584 outyielded 47 other breeding lines, while on peat soils at the Central Florida Station, CNS–4 was superior to Lee and Jackson but was outyielded by several new breeding lines.

Sweet corn. A large number of hybrids, inbreds and test crosses were screened at the Everglades Station for possible resistance to *Trichometasphaeria turcica*. Ferry Morse 107, Rogers 8–B and R–70 were very resistant while C41, C80a, C83, WC–1, WC–16 and WC–25 showed moderate to high resistance. Several station lines were found to possess true double-earing characteristics and in combination with 101T lines produced hybrids yielding two ears per plant.

In trials at Zellwood, the greatest resistance to *Trichometasphaeria* was displayed by Vaughn's 206. In a number of variety trials in different parts of the state, good results were consistently obtained with Golden Security.

Proceedings, abstracts of papers and addresses of the 57th annual Convention of the Association of Southern Agricultural Workers held in Birmingham, Alabama, February 1-3, 1960. Pp. 288.

1539 *Bennett, H. W. Some effects of inbreeding in crimson clover.* (*p. 59*).

A number of inbreeding effects, caused by three years of self-pollination, are listed. Most of the crimson-clover samples tested proved to be self fertile but not self pollinating; however self fertility varied considerably with individuals and sources, as did the degree of reduction of vigour induced by inbreeding.

1540 *Donnelly, E. D. & Clark, E. M. Interspecific hybridization in* Vicia. (*p. 60*).

In an effort to combine specific characters from certain species of *Vicia* and to study the compatibility relationship between others, pollinations were made between 30 parental pairs involving the following species: *V. angustifolia, V. articulata, V. atropurpurea, V. dasycarpa, V. ervilia, V. galeata, V. grandiflora, V. lutea, V. pannonica, V. sativa, V. serratifolia* and *V. villosa*. Partially sterile F_1 hybrids, which were more vigorous than either parent, were obtained from one cross, *V. sativa* 'Ala. 1894' ($2n = 12$) x *V. angustifolia* 'PI121275' ($2n = 10$). Chromosome pairing during meiosis in the hybrids ranged from one pair and nine univalents to five pairs and one univalent. The one and two-pair type were the least frequent. Ala. 1894 is a high-yielding variety but does not produce an appreciable amount of hard seed, a characteristic necessary for reseeding. The other parent gives a high percentage of hard seed. It may prove possible to develop from the above cross a variety combining the favourable characters of both parents.

1541 *Coleman, O. H. & Dean, J. L. A preliminary report on the effects of thermal neutron and X-ray treatments of sorghum seed.* (*pp. 60–61*).

Seed samples of each of the varieties Sart, Tracy and Wiley were irradiated with thermal neutrons and with X rays. In the R_1 generation resulting from both treatments, visible mutations primarily consisted of chlorophyll deficiencies and leaf stripes, while in the R_2 the former were the only visible mutations. No beneficial mutations of any kind were obtained.

1542 *Coleman, O. H. & Broadhead, D. M. A preliminary report of lodging evaluation studies of sorgo.* (*p. 61*).

A significant positive correlation was found between the strength of the stalk and its resistance to bending. Strength was determined either by dividing the pull in pounds required to bend the stalk by the diameter, or by squaring the diameter.

1543 *Brown, A. R. Plot technique for grain sorghum yield trials.* (*p. 62*).

The most efficient plot size for such trials was found to be 4 rows, each 5 ft. long or alternatively, 2 rows, each 3 ft. long [cf. 1468].

1544 *Harvey, P. H. Genetic-chemical relationships in plant growth. (pp. 77–78).*
It is pointed out that over the past 30 years a considerable amount of data has been obtained on varietal differences in chemical composition. There are, for example, variations in the carbohydrate composition of different genetical strains of maize.

1545 *Echols, R. M. The impact of forest genetics on forest utilization. (pp. 138–39).*
Trunk form, branching habit, specific gravity, fibre length and disease resistance are among the characters which may be genetically improved in forest trees by a judicious breeding programme.

1546 *Merrill, S. (Jun.) & Foster, G. F. Resistance of shoots of tung varieties to injury from controlled low temperatures. (p. 162).*
Shoots of five late-blossoming varieties showed significantly less cold injury than those of four normal-blossoming varieties. The budded variety G–46 was particularly resistant to low temperatures in spring and moderately so in autumn, while the selection L–273 was very resistant in spring, but susceptible in autumn. The cold-resistant varieties studied are not highly productive but are proving useful in hybridization programmes.

1547 *Ogle, W. L. Factors affecting plant production of sweet potatoes. (pp. 166–67).*
[Cf. XXVIII, 4421].

1548 *Oberle, G. D., Hardigree, J. B. & Wingard, S. A. Varietal responses in strawberries to winter injury. (p. 174).*
Trials at Blacksburg, Virginia, indicated that Pocahontas, Blakemore and Howard require a longer period of exposure to freezing or near-freezing temperatures to acquire full dormancy than do the varieties Empire, Catskill, Fletcher, Surecrop and Dixieland.

1549 *Fahmy, I. Certain berry characteristics of muscadine grape varieties growing at State College, Mississippi. (p. 175).*
A comparative study of 22 varieties is reported. Information is provided on the varieties which were above average in the following characteristics: sugar content, as measured by either soluble solids or Brix; total titratable acidity; soluble solids : acid ratio; and berry size. Also listed are the names of varieties that were below average in total titratable acidity.

1550 *Brightwell, W. T. & Woodard, O. J. Progress in rabbiteye blueberry breeding in Georgia. (p. 177).*
A number of selections have been made in the breeding programme. These include 3 selections of *Vaccinium ashei* x *V. australe*, 4 of *V. ashei* x *V. constablaei*, 7 of *V. australe* x *V. myrsinites* as well as a number of selfed *V. ashei* and *V. australe* selections. Callaway, Coastal, Homebell and Tifblue have been released.

1551 *Hawthorne, P. L., Brown, R. T., Jones, L. G., Newsome, D. W. & Miller, J. C. Plaquemine, a new seedless orange. (p. 178).*
This new variety, released by the Louisiana Agricultural Experiment Station, originated as a seedless mutation from Pineapple, a variety having 13–23 seeds per fruit. It has favourable appearance and flavour characteristics and has 0–1 seeds per fruit. Ripening is earlier than in the variety Valencia.

1552 *Singh, K. & Thompson, B. D. Investigations on the identification of vegetable varieties by paper chromatography. (pp. 181–82).*
No definite varietal differences were found in amino-acid or sugar content in a study on the identification of 10 varieties of water melon, 8 of cucumber and 13 of beans by means of 1-dimensional paper chromatography. However there were encouraging results as regards varietal identification on the basis of flavonoid differences.

1553 *Oberle, G. D. & Hardigree, J. B. The occurrence of internal cork in apple varieties and seedling populations. (p. 199).*
Observations on a number of apple varieties at Blacksburg, Virginia, indicated that susceptibility or resistance to development of internal cork may be conditioned by genetic as well as by environmental factors. Among varieties which showed relatively minor development of the disorder were Golden Delicious, Jonathan, Delicious, Winesap and Idared.

1554 *Overcash, J. P. Pear leaf spot infection and defoliation of pear varieties. (p. 199).*
Among pear varieties at Newton, Mississippi, which were only slightly defoliated by pear leaf spot, *Mycosphaerella sentina*, were Campas, Conference, Garber, Lincoln, Mooers, Orient and Pineapple. The highest degree of resistance to the disease was exhibited by a *Pyrus calleryana* hybrid tree arising from a seedling rootstock.

1555 *Oberle, G. D., Moore, R. C. & Hardigree, J. B. The Washington peach. (pp. 199–200).*
[Cf. XXX, 3116].

1556 *Harmon, S. A., Miller, J. H., Hernandez, T. & Newsome, D. Breeding sweet potatoes for resistance to internal cork. (pp. 204–05).*

The ability of the varieties HM–15, HM–36, Whitestar and Creole to transmit their resistance to internal cork has been studied at Louisiana State University. These varieties were crossed with the susceptible lines Code 130, Code 21 and Porto Rico. Cuttings from the F_1 hill were then grafted into corky Porto Rico stock and the subsequent growth was taken as cuttings to grow a crop of roots. The results indicated that crossing resistant varieties with each other gave rise to progeny with a high degree of resistance while susceptible x susceptible lines gave wholly susceptible progeny. More than half of the progeny resulting from resistant x susceptible crosses were resistant.

1557 *Young, W. A., Hernandez, T. P. & Miller, J. C. A study of heterosis in the Brassica family. (pp. 205–06).*

Louisiana Allyear cabbage, Louisiana sweet collard and L3 broccoli were crossed in all possible combinations. With the exception of the collard x broccoli cross, all the hybrids had a significantly greater weight than either parent. The height and width measurements of the hybrids were either intermediate between or greater than those of the parents. Cabbage-collard combinations were loose-headed cabbage types; broccoli-cabbage combinations were late-maturing broccoli types; and collard-broccoli crosses were collard types.

1558 *Garren, K. H. Comparative development of stem rot in a Virginia Bunch and a Virginia Runner variety of peanuts. (p. 233).*

Observations at Holland, Virginia, indicated that there were no consistent differences in susceptibility to *Sclerotium rolfsii* (*Pellicularia rolfsii*) between Virginia Bunch 46–2 and Virginia Runner 56–R. Neither variety can be considered resistant to the disease.

1559 *Giamalva, M. J., Martin, W. J. & Hernandez, T. P. Reaction of 8 sweet potato selections to five species of root-knot nematodes. (p. 234).*

[Cf. 663].

1560 *Graham, T. W. A root knot resistant tobacco breeding line released to breeders. (p. 236).*

[Cf. 743].

1561 *Young, P. A. Crease stem with bunchy top of tomato. (p. 237).*

[Cf. 1047].

1562 *Greenleaf, W. H. Resistance levels to the bacterial leaf spot disease in peppers. (pp. 238–39).*

A variety from Ceylon, G2–Deva, exhibited the highest degree of resistance to *Xanthomonas vesicatoria*. Considerable resistance was also found in Santanka and Mexican Woolly.

1563 *Carlson, L. W. & Struble, F. B. Techniques for evaluating sweet potato lines for their reaction to soil rot. (p. 239).*

[Cf. 664].

1564 *Bird, L. S. & Joham, H. E. Factors associated with the genetics and physiology of resistance of cotton to the bacterial blight organism. (pp. 244–45).*

Investigations dealing with the physiological nature of resistance to *Xanthomonas malvacearum* are reviewed. It is pointed out that while the C–N balance is associated with resistance to the pathogen, other factors too may be of significance. Thus, factors causing a shift in the C–N ratio of cotton plants would also cause a change in other plant constituents and it may be that the quantitative relationship of other organic compounds is more closely associated with the disease mechanism than is the C–N ratio itself.

1565 *Joham, H. E., Bird, L. S. & Blackmon, C. W. Amino acids in cotton varieties resistant and susceptible to* X. malvacearum. *(pp. 246–47).*

The aminoacid colour bands of three resistant and three susceptible varieties were compared. A number of differences were observed between the two groups but there is as yet not firm evidence that these differences are directly related to the presence or absence of the resistance mechanism.

1566 *Holmsen, T. W. & Teas, H. W. A genetic approach to geotropism. (p. 247).*

The reaction sequence leading to the negative geotropic response of plant stems may be divided into three phases: (1) "perception of the gravitational stimulus"; (2) transmission of the stimulus; and (3) translation of the stimulus into "geo-growth." It appears that perception results from the reorientation of particles in the cytoplasm; such particles would have a density different from that of the cytoplasm. Transmission of the stimulus and its translation into geo-growth appears to be an auxin-dependent process. Studies with specific chemical inhibitors suggest that geogrowth may be a process completely different from normal straight growth.

There are ageotropic mutants in pigeon pea, rice, maize and several other plants. An ageotropic mutant of maize, called "lazy", is being used to study the geotropic reaction. This mutant has grown normally except for geotropic response. Horizontal stem segments of lazy contain more diffusible auxin than comparable segments of normal siblings.

Furthermore, the distribution of diffusible auxin in the nodes of horizontal stems of lazy is just the opposite of the distribution of auxin that obtains in normal siblings.

1567 *Maine, E. C. & Kelman, A. Comparative physiological studies on hosts resistant and susceptible to southern bacterial wilt.* (*p. 248*).

Attempts to demonstrate the presence in healthy tobacco plants of compounds with inhibitory or stimulatory effects on *Pseudomonas solanacearum* were unsuccessful, suggesting that such compounds are probably not natural components of unaffected tissues. Inoculation tests established that excised tissues from resistant tobacco leaves, stems and roots "maintain the potential components for resistance." It was also shown that the synthesis of compounds involved in the inhibition of growth of the pathogen in resistant plants is apparently a light-dependent process occurring in leaves.

Chemical analyses revealed that on a percentage basis there was a greater increase in phenolic substances in diseased resistant plants than in diseased susceptible ones. No correlation existed between the concentration of chlorogenic acid and resistance in healthy tobacco tissues. *In vitro* tests indicated that only the oxidized form of chlorogenic acid is toxic to *P. solanacearum*. Quantitative assays of tobacco-stem polyphenol oxidase showed that activity increases were greater in resistant than in susceptible tissues as pathogenesis progressed.

The susceptibility of resistant plants was increased by the application of $2{\cdot}7 \times 10^{-3}$M sodium sulphite, glutathione or ascorbic acid to roots 48 hr. prior to inoculation. However the two latter compounds had no stimulatory effect on bacterial growth *in vitro*.

These results indicate that inhibitory compounds contributing to resistance may not be present in resistant tissues prior to the host-parasite interaction. It is suggested that the light-dependent synthesis of certain polyphenols, as well as products formed by their subsequent oxidation, may be involved directly or indirectly in the resistance mechanism to southern bacterial wilt.

1568 **72nd Annual Report of the Mississippi Agricultural Experiment Station for the fiscal year ending June 30, 1959** : Pp. 101.

Wheat. Yield, disease resistance and standing ability were very satisfactory in Bledsoe, a new variety which may replace Chancellor as an early-maturing variety in the Delta area [cf. XXIX, 278]. Further progress has been made towards the incorporation of rust and mildew resistance in Chancellor.

Oats. In the breeding programme, resistance to rusts, other fungi and cold is being combined with high forage yield and good grain qualities. Some breeding lines at the Delta Branch Station showed apparent resistance to barley yellow dwarf virus.

Rye. A new variety, Mississippi Synthetic 3, now named Explorer, has been released [cf. XXXI, 363].

Maize. Three new white experimental hybrids outyielded Dixie 55 in 1956–58 yield trials. *Rf*, a fertility-restoring gene, has been incorporated into a large number of superior inbred lines. Selection for resistance to brown spot (*Physoderma zeae-maydis*) is in progress. At the Delta Branch Station, a yellow experimental hybrid, Delta 5802, has for three years been equal to Dixie 22 in yield and superior in earworm resistance and grain quality.

Barley. Two new varieties, Pace and Oma, are being increased for distribution in Mississippi [cf. XXX, 3935].

Sorghum. Hybrid varieties of grain sorghum outyielded open-pollinated varieties in a 2-year trial at the Northeast Station. Glume types with resistance to midge attack were developed in greenhouse work. Self-fertile segregates from the F_3 of Johnson grass x sorgo crosses were selected. One segregate, SJ–2, contained notably low quantities of prussic acid under a wide range of conditions. Two other segregates produced high yields and appear to be suitable for silage making.

Rice. A breeding programme has commenced. One selection from the variety NATO matured 20 days earlier than the parent variety.

Grasses. Six lines of ryegrass with immunity to crown rust have been produced, after six cycles of artificial inoculation. Other lines possessing high resistance have been selected from five introductions. Polycrosses of the immune and highly resistant types are now undergoing further testing. A new strain of Sudan grass, developed by hybridization and selection at the Delta Station, outyielded 14 other varieties of Sudan grass and millet. The new strain has a high degree of disease resistance.

Forage legumes. Chief, a new variety of crimson clover, has been released [cf. XXIX, 1664]. A high degree of resistance to nematode root knot has been obtained in the progenies of inbred selections of red and white clovers. Certain red-clover selections are also resistant to powdery mildew. The disease-resistant selections of both species appeared to be able to withstand prolonged drought better than disease-susceptible commercial varieties. Over 200 foreign introductions of lucerne are being tested for their reaction to diseases under Mississippi conditions.

Sweet potato. A Mississippi seedling, M–97–4, which yielded as well as the established varieties, contained four times as much carotene as Porto Rico and twice as much as Goldrush. When compared in a commercial canning test with Goldrush, the new line proved easier to peel and possessed a darker, more uniform colour.

Cotton. An extensive programme of breeding, screening and evaluation has resulted in the production of a number of promising strains combining desirable agronomic and commercial properties with good resistance to *Fusarium* and *Verticillium* wilts. In a 4-year varietal test at the Brown Loam Station, Auburn has proved more disease resistant than most other entries. Further progress has been achieved at the Delta Station towards the eventual release of new lines with high yield and acceptable fibre qualities. At the same station, studies on the use of chemicals for the induction of pollen sterility have commenced. More than 75% pollen sterility occurred when plants were treated with sodium 2,3-dichloroisobutyrate. From 80 to 93% hybridization was obtained in set bolls.

Red pepper. A number of lines, superior to California Wonder and Yolo Wonder in yield and resistance to tobacco mosaic, are being tested further.

Cucurbits. Advances have been made in breeding new cantaloupes with the eating and disease-resistant qualities of Homegarden. Progress has also been made in breeding improved water melons.

Castor oil plant. Two lines showing tolerance of *Alternaria* sp. have been found.

Brassica. Cabbage lines showing resistance to black rot (*Pseudomonas campestris*) have been selected. Some cauliflower lines at the Truck Crops Branch Station possess the following desirable traits: earliness, ability to produce good heads during relatively high autumn temperatures and satisfactory head size. An effort is being made to add these characteristics to commercial varieties.

Tomato. Selection within the variety Kopiah, designed to improve fruit size and to eliminate internal browning of the fruit, is in progress.

Cowpea. Mississippi 755, which is being used as a parent in the breeding programme, is immune or highly resistant to *Fusarium* wilts, resistant to root-knot nematodes and tolerant of viruses. Nematode resistance in this and similar strains was found to be controlled by a single dominant gene.

Bean. Longval, a new bush snap bean variety, has been released [XXIX, 3246]. Extender, a new round-podded variety, was the highest-yielding variety of the Tendergreen type in 1959 trials.

Soya bean. An early-maturing line, D53–526, was increased for release under the name Hill [cf. XXX, 2076].

1569 **Results of Research in 1958 by the Agricultural Experiment Station of the University of Kentucky. 71st Annual Report of the Director** : Pp. 90.

Maize. The zinc content of 36 inbred lines was measured. Ky 211 contained 38·4 p.p.m. or 10·23 mg. per kernel, while five lines, K64, CI64, Ky36–11, Oh07 and Oh29, contained less than 18·0 p.p.m. A negative correlation coefficient of 0·05 indicated that no association existed between zinc content and weight per kernel.

The specific combining ability of the inbred lines used in the double-cross hybrids, Ky105 and Ky106A, was evaluated. The results indicated that T8 and 38–11 limit production of Ky105 and that WF9 and Oh41 limit Ky106A.

Poa pratensis. Several selections proved superior to commercial bluegrass in yield and resistance to crabgrass invasion.

Timothy. Clair was released [cf. XXIX, 1615].

Festuca arundinacea. Synthetics and polycross progenies of inbred lines were, in general, significantly better grazed than Ky31, though there were no significant differences in dry-matter yield. There was evidence that cattle consistently selected certain lines at each grazing throughout the year. A number of palatable and fertile (annual ryegrass x tall fescue) x tall fescue hybrids have been obtained. A 56-chromosome plant, produced after colchicine treatment of F_1 hybrids of ryegrass x tall fescue, was partially fertile.

Lucerne. As part of a programme to develop an adapted creeping variety, plants selected for the creeping habit were crossed with individuals from the varieties Narragansett, Rhizoma, Vernal and a selection from Atlantic. The largest number of creeping plants was found in the progeny of crosses with Rhizoma, followed by Vernal and Narragansett.

Red clover. A total of 12,780 plants of 10 varieties were scored for vegetative vigour and virus tolerance in their second year of growth. Both characters were strongest in Kenland and weakest in Ky215 and Sanford. A positive association ($r = 83$) between the two characters was found. Most of the progeny of a self-fertile plant, which matured seed in 1957 and 1958 without artificial tripping, proved to be autogamous. The selection designated KyBYM(204–1)R Red Clover No. 1 has shown some resistance to bean yellow mosaic virus.

Tobacco. Genetic abnormalities have been studied with the help of 24 monosomics obtained from the University of California, Berkeley. The gene for vein-banding has been located on chromosome G [cf. XXX, 201]. Virescent, a chlorophyll deficiency, produced one virescent plant when crossed with monosomic D, suggesting that the mutant gene may be on chromosome D. Other crosses indicated that the genes for silver variegation and variegation H are on the L chromosome and that the gene for yellow Crittenden mutation is on chromosome J. Variegation I, which results in greatly distorted white and green leaves, has been found to result from a dominant mutation. A narrow-leaved mutation causing seedling leaves to be reduced to midribs and adult leaves to be very narrow was found in several breeding lines of dark tobacco. A dominant mutation, resulting in leaves 1/4 to 1/5 of normal size, occurred in Burley tobacco.

Two cultures of *Phytophthora parasitica* var. *nicotianae*, able to infect normally resistant tobaccos, have been isolated.

It has been found that at least four major gene pairs control total alkaloid content and that all of these must be in the recessive state for the lowest alkaloid level to occur. Marked shifts in segregation patterns of lines grown under differing environmental conditions emphasized the necessity for environmental controls in studies on the genetics of alkaloid production.

Resistance to wildfire (*Pseudomonas tabaci*), derived from *Nicotiana longiflora*, is present in Burley 21 and Ky61. Studies of *N. longiflora* x *N. tabacum* hybrids showed that translocation had taken place and that the *N. longiflora* segment was located on different *N. tabacum* chromosomes in the two varieties.

Resistance to the green peach aphid (*Myzus persicae*) was found in a number of selfed lines and crosses, which are now undergoing further testing. Burley 21 was the most resistant variety in a 10-entry trial. Ex.4 and GR37 were almost as resistant as Burley 21. Two new experimental lines of Burley showed considerable promise at the Princeton Substation. They were resistant to black root rot (*Thielaviopsis basicola*), wildfire, mosaic and *Fusarium* wilt. Experimental lines of dark tobacco with very good resistance to wildfire and mosaic have been obtained at the same station. Some of these lines also have resistance to black root rot.

Strawberry. Promising selections from crosses effected between 1950 and 1954 are undergoing further testing. A number of new crosses have been made.

1570 What's new in farm science.

Bull. Wis. agric. Exp. Sta. 1959
No. 538 : Pp. 103.

Cereals. Studies on the inheritance of straw strength in barley are in progress; a world-wide search for barley varieties which possess this character is being conducted. Goodfield oats has been released [cf. XXX, 322]. A programme for giving early warning of impending maize rust epidemics is reported. W417, a new high-yielding maize hybrid in the 95 maturity group, has been released. The new hybrid outyielded W416AA, which is in the same maturity group, by several bushels per acre in 1958 field trials. Its ears are compact, medium in shape and size and easily husked. It is stated that dwarf hybrids of suitable maturity for Wisconsin are not yet available. Problems associated with dwarfs include their low yielding ability and the difficulty of breeding reliable parent stock.

Forage grasses. A new method of testing cyanide levels in Sudan grass has been devised. Attempts to breed a variety with a cyanide content lower than that of Piper are continuing.

Forage legumes. Lakeland, a high-yielding, mildew-resistant red clover, has been released [cf. XXX, 2779]. A popular account is given of studies on cold resistance in lucerne and red clover.

Potato. Studies on haploid potatoes conducted by R. W. Hougas and S. J. Peloquin at the Sturgeon Bay Experiment Station are described [cf. XXIX, 1713–5, XXX, 521].
Apple. Two promising new selections, Puritan and Red Sharon, are undergoing further testing.
Beetroot. Attempts are being made to select varieties which will grow satisfactorily in boron-deficient soils.
Radish. Red Prince, which was selected from Scarlet Globe on the basis of resistance to *Fusarium* wilt, has been released. The new variety is characterized by a very short top and a round red root. A high percentage of marketable roots is produced.

1571 **New Mexico agriculture advances with research. 70th Annual Report of the New Mexico Agricultural Experiment Station for the fiscal year ended June 30, 1959** : Pp. 94.

Wheat. Most of the selections developed at the Plains Substation and to undergo trial in the near future include Cheyenne in their parentage.
Sorghum. Breeding to produce lines of grain and forage sorghums and broomcorn, for use in F_1 hybrids, continued.
Lucerne. Progress was made in breeding for resistance to spotted aphid (*Therioaphis maculata*); most of the progenies having the best rating for resistance were of Zia parentage. The experimental synthetic NM22–1 was especially promising. Resistant to spotted aphid, it was slightly inferior to Zia in forage yield and disease resistance but better in quality. Three other synthetics, as well as seven two-clone synthetics, were also produced. Zia and Lahontan plants were screened for degrees of resistance to spotted aphid. Both varieties exhibited a wide range of resistance. Various investigations were carried out on the nature of resistance.
Sweet potato. Apache was released [XXX, 1732]. The variety is resistant to black rot, root-knot nematodes and cracking, and has also shown a low incidence of internal cork disease.
Cotton. The outstanding feature of strains chosen for advanced testing is their high spinning quality as compared with the standard, Acala 1517C, at present considered to be one of the American varieties of *Gossypium hirsutum* with the best quality. Yarn strength of breeding lines was predictable with a fair degree of accuracy from three measurements on the raw fibre: "upper half mean length in inches; fiber strength in Stelometer index units at one-eighth-inch gauge length; and Micronaire fineness." Only 12% of the variation in yarn strength was unaccounted for by the three measurements. In selection of F_2 and more advanced material, tolerance of *Verticillium* wilt and resistance to races 1 and 2 of bacterial blight received attention. The possibility of inducing mutation for bacterial-blight resistance by X irradiation is being explored.
Sugar beet. Progress has been made in developing varieties resistant to *Cercospora* leaf spot.
Pecan. Promising selections have been produced.
Onion. Work continued on developing F_1 hybrids of the White and Yellow Grano types. Many F_2 hybrids from crosses of White Grano inbreds with line L303A of Crystal Wax, which carries a gene for resistance to pink root (*Pyrenochaeta terrestris*), showed disease resistance but only a few produced bulbs approaching the standard for bulb shape; back crossing to the Grano parental lines will be effected.
Pinto bean. Material selected for field resistance to rust and other characters included an X_3. Some new strains under test were immune or resistant to a rust epidemic in the field. X_2 and X_3 selections and F_1 selections of Great Northern x Tepary were tested for resistance to common bacterial blight in the greenhouse; some progenies appeared to have tolerance. In crossing, use of a mixture of 0·1% sodium 1-naphthalene-acetate and powdered talcum reduced fruit drop and increased pod set and seed size.

1572 **Washington's research progress in agriculture and home economics.** Ext. Misc. Publ. Ext. Serv., Inst. agric. Sci., Wash. St. Univ. 1960 : No. 54 : unpaginated.

Cereals. About 3800 varieties of cultivated oats, 1000 spring wheats and 1000 barleys were screened for resistance to yellow dwarf virus at the Southwestern Station. Several Ethiopian barleys were found to be resistant, while 400 oat varieties and 100 spring wheats were selected for further evaluation.
Breeding aimed at developing wheat varieties with rapid emergence is in progress. The genetic factors restricting coleoptile elongation are being studied. Among many promising semidwarf winter wheat selections is one which was superior to Omar in resistance to bunt, leaf rust, lodging and shattering.

Among variants observed in populations of irradiated Omar and Burt were short-strawed plants and types with awned or common-type heads instead of the regular club. The use of special X-ray techniques on grass x wheat crosses allowed the successful transfer of desirable characteristics, e.g. bunt resistance, from the grass parent to the progeny. Wheat plants with high lysine content have been found. Several selections of high-protein type red winter and spring wheats, designed for northwest Washington, have shown outstanding milling, baking and agronomic characteristics. Over 100 selections of spring wheat were tested under irrigation conditions at the Prosser Station; about 15 have been selected for further testing. Other spring wheat selections showed resistance to both leaf and stem rust, when tested at Winnipeg, Manitoba.

Considerable progress has been made in breeding a high-yielding, two-rowed barley for eastern Washington. The development of a hull-less barley for poultry feed and human consumption is in progress.

Forage crops. Studies are being conducted to determine the feasibility of X irradiation in separating out some of the wheat characteristics that could be introduced and might be desirable in grasses. Two bromegrass species yielded well enough to warrant further testing. Three Bromus species, grown at Lind, were found to be lower in lignin than Manchar. Considerable differences were found in winter survival of the 21 clones constituting Pilgrim Ladino clover. It is pointed out that knowledge of the performance of individual clones is essential in the selection of parental clones for a synthetic.

Potato. Four selections showed no symptoms of either *Verticillium* wilt or leaf roll at the Irrigation Experiment Station. At Pullman, three seedlings have remained healthy after five years of exposure to leaf-roll infection.

Peach. Two selections, PO–766 and PO–1194, gave promising results in trials conducted at several localities in Washington as well as in other parts of North America.

Raspberry. More than 1000 new seedlings of Sumner were grown at Puyallup in an effort to combine its superior hardiness and root-rot resistance with greater fruit size.

Strawberry. Sixteen everbearing selections were propagated for further evaluation; three of these appear to be superior to present everbearing varieties of the Pacific northwest. Midway [cf. XXX, 4294], Frontenac [XXX, 3157] and Fletcher [XXX, 3157] have been released. A greenhouse technique for evaluating the relative tolerance of selections to four common viruses has been developed.

1573 **Director's Annual Report of the Chilean Agricultural Program, August, 1958–July, 1959** : Rockefeller Found., NY : Pp. 25.

Spring wheat. The new variety Rulofén has been released, selected from Colombian material for extreme earliness, stiff straw, disease resistance and high yield.

Of hybrids tested in the central zone of Chile, Lerma x Quaderna was highest yielding and resistant to leaf and stripe rust, and possibly immune to stem rust.

A large number of F_1 crosses between spring and winter varieties are being evaluated.

Winter wheat. Vilmorin 29 and Cappelle Desprez remain the most satisfactory varieties. Some of the Japanese dwarf types have been crossed with French types. Screening for baking qualities has shown that 33 hybrids are of a high standard.

Sorghum. The local variety Milan appears as good as or better than any introduced variety that has been tested.

Harding grass. Much variation among a collection of clones throughout Chile indicates good possibilities for selection.

Cocksfoot. The two local varieties, Adriafén and Centifén, have been developed. Australian varieties, in particular Currie, and New Zealand varieties have also shown up well.

An intensive breeding programme is planned, based on locally selected plants.

Ryegrass. Individuals in certain varieties appear to carry a high degree of resistance to *Puccinia rubigo-vera* and *P. graminis*.

Lucerne. The variety Moapa has been superior to all others in seedling vigour and has done well in other respects. Caliverde has the advantage of being resistant to bacterial wilt. Both upright and creeping types have been evaluated for growth habits and disease resistance, and hybridizations of superior creeping types with nonhardy varieties have been carried out with a view to developing creeping types which will not become completely dormant in the winter.

Red clover. Local strains, one in particular, have proved superior to all other varieties in respect of seedling vigour, yield and disease resistance, with the exception of some material imported from Italy. Variation within local strains in vigour and disease resistance lends itself to selection.

White clover. Ladino types are now generally recommended for Chile.

Subterranean clover. The most promising varieties are Bacchus Marsh, Yarloop, Dwalganup and Mount Barker.

Lotus. *L. corniculatus* has been found to be superior to *L. uliginosus* and *L. tenuis* as it remains productive for a longer period. Two strains from Brazil and Argentina respectively have shown an excellent winter growth habit. Selections have been made principally from *L. corniculatus,* for vigour and ability to persist under conditions of extreme drought; selection within *L. uliginosus* is planned.

1574 **Director's Annual Report of the Colombian Agricultural Program, May, 1958–April, 1959** : Rockefeller Found., NY : Pp. 128.

Wheat. Multiline varieties are under test in an endeavour to find one suitable for farm use and also for use in future genetical research projects.

Mexican dwarf wheats are being extensively used in hybridization experiments and dwarf lines occurring in the breeding plots are being used as sources of short stiff straw. Genetic studies on the inheritance of resistance to yellow rust are in progress, in particular of the variety Bonza.

The variety Toca 59 is replacing the yellow rust susceptible Menkemen, and Nariño 59 and sister selections are intended to provide yellow-rust and dwarfing-virus resistant varieties.

Oats. Breeding work is directed towards the production of a variety resistant to crown and stem rust, early maturing and resistant to lodging. Four varieties have been obtained which are acceptable in these respects with the exception of stem-rust resistance.

Selections from a world oat collection have been made for the qualities mentioned above and 28 of them show high resistance to stem rust, and a large number to crown rust. Selections suitable for the production of early lines have also been made.

Maize. A new yellow hybrid, Diacol H–205, has been released, adapted for regions 600–1200 m. above sea level, and with excellent qualities.

For higher altitudes, Diacol H–301 and H–352 were due for release in 1959. The production of synthetics and of intervarietal crosses is being continued.

Genetic studies include investigations into the behaviour of pollen restorer genes, the mode of gene action and its bearing on selection procedures, and chromosome-knob position. This last may lead to new hypotheses on the origin of certain maize types.

A number of inbred lines with high resistance to *Diatraea* spp. have been selected and genetic studies on the inheritance of resistance are in progress. Other inbred lines have been obtained showing resistance to *Fusarium* sp., *Diplodia zeae* and *Helminthosporium turcicum* (*Trichometasphaeria turcica*) respectively.

Promising sources of resistance to *Laphygma frugiperda* have been found in several sisters of the line ETO 182 C.

Barley. Breeding work has been directed at the production of varieties incorporating high yield, stiff straw, earliness and disease resistance, particularly to dwarfing disease. Nineteen selections have been found resistant to this, and the variety Galeras is also resistant to loose smut. This variety is early and of good quality but not equal to the susceptible variety Funza, which is being used in back crosses with resistant hybrids.

Inheritance studies are in progress with regard to resistance to dwarfing and loose smut.

Rice. Several introductions from the USA have shown promise as sources of breeding material for producing long-grained varieties with short strong straw, earliness and disease resistance.

Japanese short-grain types which are resistant to white leaf virus disease are being used in hybridization experiments to produce a satisfactory resistant long-grained variety. A genetic investigation of the inheritance of resistance has been initiated. Wild varieties of *Oryza* have also been tested for reaction to white leaf, and nearly all were found to be resistant.

Forage grasses. The Italian ryegrass varieties La Estanzuela, Beaumont and Tipton are productive, persistent and show signs of rust resistance. Intravarietal and intervarietal crosses between La Estanzuela and PI162678 are planned as a beginning of an improvement programme.

Three varieties of Sudan grass have been high yielding and drought resistant: Tift, Greenleaf and Lahoma.

A study of resistance to *Xanthomonas axonoperis* in imperial grass is in progress. Inbreeding of Sudan grass and forage sorghum has reached the F_3, and after further selection, the inbreds will be recombined for the production of synthetics.

Lucerne. The highest yielding variety at high altitudes is du Puits; at lower altitudes Chilean-Arizona, Peruvian, India and California Common have been most productive. The Mexican varieties Atlixco and Oaxaca show promise in cool regions.

Red clover. The varieties Kenland, Midland, Port Gibson and Pennsacott give a superior quality hay about equal in quantity to Nolins. Apparently the day length in Colombia affects the flowering of different varieties in different ways.

An improvement programme has been initiated.

White clover. Ladino types such as Pilgrim and Oregon yield less than Louisiana types in the first year, but production is more than doubled in the second year, and the plants are more persistent in dry weather.

An improvement programme has been initiated.

Vetches. The most promising selection is the Mexican Toluca.

Sweet clover. Hubam, Tift and Florana are recommended as green manure at altitudes of 2000–9000 ft.

Potato. Several hundred hybrid seedlings have been selected for further observation. The variety Monserrate (hybrid 50–57–67) is being distributed.

About 1000 clones of species and hybrids have been rated for reaction to *Phytophthora infestans*. Races 0; 1; 2; 4; 1,2; 1,4; and 2,4 of this pathogen have been identified in Colombia. The nature of field resistance is being investigated.

1575 **Annual Report of the Director of Agriculture of British Guiana for the year 1959** : Pp. 76. (Mimeographed).

Rice. Some of the problems and aims in rice improvement are discussed; it is pointed out that mass selection methods have not proved effective and therefore pedigree selection has been resumed. Of 126 varieties tested for resistance to blast, *Piricularia oryzae*, only Dima, from Surinam, showed some resistance.

Sugar cane. The cultivation of the new variety B47258 has increased during the past year. It is drought resistant but is susceptible to damage by rats, borers and aphid. Promising varieties undergoing further testing are D37/45, B45137 and D141/46.

Details are given on the performance of introduced varieties of a wide range of vegetable crops, notably tomato, dhall (*Cajanus cajan*), sesame and castor.

1576 VAN EMDEN, J. H.
Jaarverslag 1959. Landbouwproefstation, Suriname. (**Annual Report, 1959. Agricultural Experiment Station, Surinam**) : 1960 : No. 22 : Pp. 116.

In addition to the work described below, testing of cowpea, citrus rootstocks, banana, coffee and oil palm is under way.

Rice. Holland 5023 appears to be a useful parent with respect to rapid early growth, vigorous vegetative development and resistance to white-leaf virus, several promising populations having been derived from this variety. X-ray and colchicine induced mutants of Holland 5025/10 and other varieties are under study. In all trials in which it has been tested, the variety Skrivimankoti proved highest in yield.

Cacao. Among plants grown from seeds of SCA12 x SCA6 and SCA12 x DR1 obtained in September 1957 and February 1958 were a few early-bearing types which fruited in November 1959.

Groundnut. Large-seeded forms and forms with the Virginia type of branching instead of the Spanish type have been obtained as a result of the X irradiation of the variety Matjan.

Tomato. Anahu is resistant to root-knot nematode but susceptible to *Cladosporium fulvum*.

Phaseolus. Two types occurring frequently in X-irradiated material of *Ph. radiatus* were (1) small unbranched plants with very long, hanging pods, large glossy seeds and large leaves and (2) large, branched plants with short, horizontally projecting pods which are constricted over part of their length, rather small dull seeds and small leaves.

Soya bean. X_6 lines of Laris and Vada have been obtained which significantly exceed the initial varieties in yield and seed size.

1577 COLEMAN, P. G.
Annual Report of the Department of Agriculture of the Federation of Malaya for the year 1958 (1959) : Pp. 98.

Brief reports on varietal trials carried out by the Agronomic Investigation Branch are presented. The crops dealt with include rambutan, banana, durian, tea, coffee, maize and guinea grass.

Rice. Variety trials in different parts of Malaya are reported [cf. XXX, 2365 and 2366]. Pure-line selection trials have continued, the outstanding lines being Radin Ebos 33 and Radin Ebos 64. *Indica* x *japonica* hybrids from Cuttack, India, have consistently yielded well but there is some evidence that they may be more susceptible to stem borer and a physiological disease, penyakit merah, than local varieties.

Further work with X-ray treatment has continued and a nonphotosensitive mutant, Siam 29, has been obtained; it is to be incorporated into future breeding work.

Cacao. Amelonado and Indonesian Trinitario have proved susceptible to a die-back disease of unknown cause but the local near-Criollo Trinitario has shown some resistance. Unsatisfactory yields were obtained from both Amelonado x Nanay 32 and Amelonado x Malayan Trinitario crosses.

Oil Palm. Breeding and progeny testing have continued with particular attention being paid to the provision of *tenera* progenies with standard *pisifera* parentage.

Pineapple. A total of 67 clones from the Singapore Spanish collection has been retained for further trial, while other material has been discarded. At Sarawak, 19 superior plants have been retained; 77 clones have been selected as promising material from the Australian Smooth Cayenne collection.

1578 Report of the Department of Scientific and Industrial Research, New Zealand for the year ended 31 March 1960 : Pp. 128.

Breeding projects in progress on cereals, forage species and other crops are listed. In addition, information is included on the following new varieties:—

Potato. A search has been made for varieties with strong growth so that they are able to withstand wind and drought and control weeds, and also with resistance to late blight. The late-maturing varieties Tahi (Sebago x Harford) and Rua (Katahdin x Harford) show promise of meeting these requirements.

Hop. First Choice and Calycross, respectively early and midseason in maturity and both resistant to *Phytophthora* root rot, are shortly to be released. A late-ripening variety, Smooth Cone, also root-rot resistant, will probably be released in 1961. All three varieties are higher in quality than Californian.

Rape. Selected from a cross between an aphid-susceptible rape and a resistant swede, the rape Aphid Resistant is to be distributed. In the absence of aphid attack, it equals Broad-leaf Essex in yield. Lambs have found the variety as attractive as Broad-leaf Essex.

1579 Annual Report of the Queensland Department of Agriculture and Stock 1958-59 : Pp. 106.

Wheat. Breeding at the Hermitage Regional Experiment Station has been mainly concerned with rust and frost resistance, yield and flour quality. In tests at this station and on the Darling Downs, new hybrid selections were compared with standard commercial wheats. The stem-rust resistance of varieties such as Gabo, Charter and Koda broke down through attack by a new race. Spica, Festival and Lawrence retained their stem-rust resistance. Spica, Koda and Charter were badly damaged by frost. Among the early varieties, the back-cross derivative of Puora, to be released as Kenora, outyielded Spica and Gabo. Of the midseason entries, six new hybrids, including a Lawrence x Gabo selection, surpassed Festival, Koda and Charter in yield; it is hoped to release this selection as Gala. Of the late wheat, the new release HSPFSH5016, now named Hopps, shared top position with Lawrence.

Maize. Hybrids have been produced in recent years for most of the main maize-growing areas but suitable hybrids remain to be developed for the south-eastern Darling Downs and Atherton Tableland.

Sorghum. Several hybrids have been bred which are now available for testing.

Citrus. Observations on tangor selections (orange x mandarin) suggest that this type could play an increasingly important part in the mandarin industry.

Passiflora. Progenies of *P. edulis* x *P. edulis* f. *flavicarpa* are undergoing selection for disease resistance and other characters. The flowering and fruiting habits of these parents and their hybrids show considerable differences; variation in time of cropping could have a material effect in reducing loss due to the virus disease known as woodiness.

Tomato. The hybrids Potentate x Stokesdale and Q2 x Salads Special are the most promising winter types but their appraisal may be complicated by the high incidence of leaf-shrivel virus at the Redlands Experiment Station.

Bean. Addition of resistance to angular leaf spot (*Isariopsis griseola*) to the multiple disease resistance of the recently released variety Redlands Beauty is receiving attention. Progress is being made in developing a stringless variety.

1580 **Eleventh Annual Report of the Commonwealth Scientific and Industrial Research Organization, Australia for the year 1958-59** : Pp. 181.

Genetics of *Arabidopsis*. A study has been made of the genetics and physiology of two races requiring biotin above 28° C. In both races the requirement is determined by a single recessive mutation. With a view to elucidating the physiological activities of polygenes, the biosynthetic sequence leading to the formation and utilization of p-aminobenzoic acid is under investigation. Five out of 43 races were extremely sensitive to high temperature but the growth rate was restored to normal by addition of such substances as biotin and cytosine to the medium [cf. XXX, 37]. Forty races have been grown under six different conditions of temperature to define measurable homeostatic parameters. The interaction of a major gene with its modifier complex is being analysed in crosses between an early and a late flowering race exhibiting an allelic difference for a locus which has a large effect and also modifier complexes.

Grasses. A detailed comparison has been made between the climates of Australia and the Mediterranean region, with particular emphasis on length of growing season. This work will provide a basis for elucidating the performance of ecotypes of *Phalaris* and other grasses, when tested in Australia.

Synthetic alloploids of *Ph. tuberosa* x *Ph. minor* and *Ph. tuberosa* x *Ph. arundinacea* have been produced and are shortly to undergo field trial. Twenty-eight selected introductions of *Ph. tuberosa* have been top crossed with the commercial type and one introduction. Interspecific hybrids of *Phalaris* are being studied in order to make a genome analysis of the genus. Improved techniques of crossing within *Ph. tuberosa*, based on detection of incompatible pollinations, have been developed. They involve the staining behaviour of the pollen on the stigma and use of dominant seedling marker genes, and make it possible to distinguish three major groups, viz. strongly self incompatible, weakly self incompatible and self compatible.

The possibility of inducing awnless *Hordeum bulbosum* genotypes is receiving attention. Preliminary studies of 2*x* *H. bulbosum* suggest gametophytic control of incompatibility.

Investigations on the distribution of chromosome races of *Themeda australis* in southern Australia have been completed [cf. XXX, 4015]. Cytotaxonomic studies of Australian species of *Danthonia* have also been completed.

Being both self and cross pollinating, *Sorghum almum* shows considerable variation within and between strains. Leafiness, degree of tillering, time of maturity, seed colour, sugar content and cyanogenetic activity of different varieties have been assessed and breeding to produce types suited to areas with a rainfall of 20–30 in. has been initiated.

Rhodes grass (*Chloris gayana*) is being studied with respect to its cytology, embryology and strain variation in yield, leafiness, time of flowering, stolon development, persistence and frost tolerance.

Apomixis is being investigated in *Paspalum plicatulum*, *P. urvillei* and *P. scrobiculatum* with a view to discovering means of inducing variation in apomictic grasses.

Lucerne. Seedling progenies from crosses between winter-growing strains and creeping-rooted lines are being selected for the creeping-rooted habit by a glasshouse test at the Division of Plant Industry, Canberra. Selections responding to this test are being further selected in the field for productivity and the creeping-rooted habit. In collaboration with the Canadian Department of Agriculture, analyses are being made of data on this habit obtained at Swift Current, Sask.; most genetic variation appears to be additive.

Analysis of F_1s indicated that mass selection for cold hardiness may be expected to be effective.

In Queensland, a creeping-rooted variety for the "brigalow" country is being sought. Crosses have been made between selected clones from creeping Canadian introductions and strains adapted to relatively low altitudes from Australian, South American and Indian sources. The frequency of creeping hybrids in the F_1 and F_2 was low and the majority of such hybrids are winter dormant. Creeping-rooted strains with good winter growth have been selected and crossed.

***Medicago tribuloides*.** Strain differences were found in the influence of temperature on relative growth rate, net assimilation rate and percentage increase of total-plant dry weight. One strain from Greece and another from Morocco had a greater range of heat tolerance than others.

Data on 36 strains revealed a high degree of interstrain incompatibility. In most cases ovule degeneration and abortion occurred 5–10 days after fertilization.

Subterranean clover. Analysis of genetic incompatibilities within the species continued. Mixed hybrids and parental pure lines were sown at seventeen centres to study the effects of natural selection. At Deniliguin, hybrids were again more competitive than pure lines.

Differences in dormancy between strains have been found in seed up to five years old.

Selection for sward productivity received attention. One of the hybrid selections tested yielded 25% more dry matter in the August harvest than Bacchus Marsh, the best commercial variety. This hybrid is also resistant to rust and stunt virus.

In a survey of 320 strains, only Tallarook, Hills Small and Bass were found to be markedly resistant to stunt virus. Hybrid derivatives of Tallarook are now being tested for resistance. A midseason line selected from an F_2 of Tallarook x Northam First Early has proved highly resistant.

An R_2 population of Tallarook had a significantly increased variability in flowering time. The earliest mutant flowered seven days before the earliest flowering control and the latest flowering mutant eleven days later than the latest control. The total variances in the R_2 population increased with dose, both within and between-family components increasing linearly with dose, except for a plateau at the highest dose. Variation in flowering time was independent of morphological or other visible variation.

Other forage legumes. A small F_2 of *Indigofera spicata* (*endecaphylla*) raised from almost sterile crosses between biennial strains from Africa and a perennial strain from Ceylon showed wide variation in morphology. An X_2 yielded a range of mutant types.

Selection of *Leucaena glauca* for high dry-matter and protein contents, branching habit, good seeding ability and low mimosine content is being made within large F_2 populations from interstrain crosses. Genetical investigations have been initiated.

Selections of *Phaseolus atropurpureus* combining vigour, stoloniferous habit and good seeding ability were made from a cross between two Mexican strains. Populations of these selections growing in swards with Rhodes grass are being assessed for persistence and vigour under grazing.

Mutants of the cleistogamous species *Lotononis bainesii* which are resistant to the virus disease legume little leaf are being sought in material raised from Co^{60}-treated seed.

Tobacco. At Canberra, resistance to blue mould (*Peronospora tabacina*) has been found in a single plant of Virginia Gold, as well as in various Australian species of *Nicotiana* and in *N. knightiana*. Resistance in the spontaneous mutant of Virginia Gold appears to be determined by a single dominant gene with reduced penetrance. When seedlings of *N. debneyi* were tested under conditions of severe inoculation and high humidity, resistance seemed to depend on a single gene with low penetrance, or to be polygenic. Field segregations, however, have suggested that resistance in this species is due to a single dominant gene. Ultraviolet treatment of pollen grains has induced mutation for resistance, similar in its expression to the natural mutant under conditions of both natural and artificial infection. A further resistant line has been isolated from a seed treated with a chemical mutagen. All resistant lines available have undesirable characters; breeding has been undertaken to combine resistance with commercial suitability.

Breeding for improved yield and leaf quality under conditions in northern Queensland continued at Mareeba. As a possible aid to this project, yield components were analysed in commercial varieties. Lines resistant to blue mould have been bred, resistance having derived from *N. debneyi* or *N. goodspeedii* and through natural and induced mutation.

Tomato. Radiation-induced mutants have been secured which are resistant to the common strain of *Meloidogyne javanica*. A strain of the pest capable of overcoming the resistance of all the mutants has however been isolated. Screening for resistance to this strain is under way.

Soya bean. High-yielding strains adapted to the fertile soils of the Darling Downs and brigalow area in Queensland have been developed and are to undergo extensive testing.

1581 **Research and scholarship in the University of Sydney, 1957.** 1960 : Pp. 157.

Wheat. Variability in *Puccinia triticina* was further studied. The widespread occurrence of strains now prevalent on Spica has led to doubts concerning the alleged parentage of this variety. Work on hybridizing strains of *P. graminis* var. *tritici* on wheat seedlings continued. From two parental cultures, up to 11 new cultures were recovered as progeny. The view that nuclear exchange is important in somatic hybridization now appears untenable. By means of monosomic and nullisomic analysis of *Triticum vulgare*, determination of the sites of the genes for leaf-rust and mildew resistance continued. A study has also been made of the cytological behaviour of the *Agropyron* chromosome conferring resistance to both *P. triticina* and *P. graminis* var. *tritici*. It appears to be carried either as an univalent or bivalent in addition to the 42 chromosomes of wheat in advanced lines selected for resistance. Where a bivalent is present, pure-breeding lines are obtained. By breakage following X irradiation, an attempt was made to transfer the part or parts responsible to the wheat set of chromosomes.

Barley. Further translocation stocks were used in crosses to locate genes for leaf-rust and mildew resistance. Other studies established that mildew resistance is governed by multiple alleles or closely-linked genes.

1582 Unsere Nationalpreisträger 1960. (**Our national prize winners, 1960**).
Dtsch. Landw., Berl. 1960 : **11** : 526–28.

Some appreciative remarks are made on the plant-breeding work of H. Stubbe, on the occasion of his being awarded a first class prize in the German Democratic Republic.

1583 Watkins, P. W., Malm, N. R., Hittle, C. N. & Seif, R. D.
A portable tape recorder for taking field notes.
Agron. J. 1960 : **52** : 667–68.

The use of a portable tape recorder at the Department of Agronomy, University of Illinois, is described. It is noted that the apparatus has been especially useful in forage-crop breeding in making notes on single plants.

Annual Report of the National Institute of Genetics, Japan 1958 (1959) : No. 9 : Pp. v + 144.

1584 *Kihara, H. Studies on the nucleus-substitution and -restoration in the reciprocal hybrids,* Triticum vulgare *x* Aegilops caudata. (*pp. 29–31*).

[Cf. XXX, 2168].

1585 *Sakamoto, S. Ecogenetical studies in* Agropyron *II.* (*pp. 32–33*).

Morphological observations on the F_1 plants from a cross between an early ecotype [cf. XXX, 1153] and the common type of *A. tsukushiense* var. *transiens* are presented in tabular form. Tetravalent formation was observed in 14% of the 163 PMCs examined. Pollen and seed fertilities were lower than in the parents but were reasonably good.

Artificial and natural hybrids of *A. tsukushiense* var. *transiens* ($2n = 42$) x *A. ciliare* ($2n = 28$) tended to resemble the first parent, although the lemmas were pubescent as in the *A. ciliare* parent. Both hybrids were vigorous but completely sterile. Chromosome configurations at meiosis ranged from $9_{II} + 17_{I}$ to $15_{II} + 5_{I}$ with the mode at $14_{II} + 7_{I}$.

1586 *Tateoka, T. Cytotaxonomic studies in Poaceae, VI.* (*p. 33*).

The following chromosome numbers are reported: *Leptaspis cochleata*, $2n = 24$; *Streptogyna crinita*, 24; *Arundinella villosa*, 14; *A. leptochloa*, 20; *Garnotia scoparia*, 20; *Perotis patens*, 40; and *Spinifex littoreus*, 18. To examine the systematic relationship between *Garnotia* and *Arundinella*, their leaf structure was studied. Features were found which suggest that the two are related, but since their spikelet structure is quite different it is considered that *Garnotia* should be treated as belonging to a distinct tribe, the Garnotieae [cf. XXIX, 3930].

1587 *Oka, H.-I. Glutinous and non-glutinous isogenic lines in rice.* (*pp. 34–35*).

The nonglutinous variety Taichung 65 was crossed with the glutinous variety Kinoshita and back crossed repeatedly to the Taichung parent. By selfing a BC_7 plant heterozygous for the glutinous character, homozygous lines were obtained which differed from each other only in the glutinous character and, possibly, some minor genes linked with it. Yield trials of the progenies showed that, while the nonglutinous lines yielded slightly more than the glutinous, the difference was not significant. It is therefore concluded that the lower yields associated with glutinous varieties are not attributable to the glutinous gene itself, but probably to other genes linked with it.

1588 *Morishima, H. & Oka, H.-I. A systematic study of* Oryza *by statistical methods.* (*pp. 35–36*).

Correlations between 12 species were computed from measurements of 20 characters in an attempt to find systematic relationships among *Oryza* species by nonsubjective means. The two species between which correlation was highest were chosen as the nucleus of the group to be formed. The third species, showing the highest average correlation with members of the nucleus, was then added, and so on. The limit of the group was assumed to be determined by a drop of more than 0·20 in the correlation coefficient. When the limit was reached a second grouping was constructed and related to the first by intergroup correlation; the process was continued until all the species were accommodated.

Some reservations are expressed concerning the adequacy of the number of characters used, but the results when presented in a tree-like diagram are not far from the previously established classification of the genus. *O. minuta* and *O. officinalis* are rather nearer to the group of cultivated species and its relatives than to *O. latifolia* and *O. alta* which form another group together with *O. australiensis* and *O. eichingeri. O. ridleyi*, which was thought to be separate from the others, was found to be correlated with *O. breviligulata*.

1589 *Morishima, H. & Oka, H.-I. Discrimination between* Oryza sativa *and* O. glaberrima *by morphological characters.* (*pp. 37–38*).

Formulated to maximize the ratio of variance between groups to variance within groups, the linear function $X = x_1 - 0{\cdot}76x_2 + 0{\cdot}42x_3 - 0{\cdot}22x_4 + 0{\cdot}48x_5 + 2{\cdot}70x_6$, where x_1 represents length x width of grain (mm.^{2}), x_2 length/width ratio of grain, x_3 empty lemma length (mm.), x_4 number of first rachides, x_5 panicle length (cm.) and x_6 ligule length (mm.), was applied to 20 *O. glaberrima* and 30 *O. sativa* varieties. It was found that F for intergroup variance of the composite character X was higher than the highest value given by a single character, and was generally effective in distinguishing between the species, although a few intermediate varieties were found. Some varieties described as *O. glaberrima* were found by this method to be closer to *O. sativa*. A few *O. sativa* varieties which were glabrous nevertheless had X values well within the range for that species.

1590 *Oka, H.-I., Chang, W.-T. & Narise, T. A preliminary note on investigation of wild and cultivated rice strains collected from the mountain region of Orissa State, India.* (*pp. 38–40*).

Discriminant functions were formulated for the classification of 200 rice strains into wild and cultivated forms and into *japonica* and *indica* types. Most of the strains were either wild forms or intermediate between wild and cultivated forms; very few cultivated types were found. A few *japonica* types occurred but most strains were intermediate between typical *indica* and *japonica* types.

1591 *Sakai, K.-I. & Narise, T. A study of the flowering time in wild rice.* (*pp. 40–42*).

Tabulated data are presented on the flowering time (date of sowing to first day of flowering) of populations of *Oryza rufipogon* (*O. sativa* var. *spontanea*) and *O. perennis* collected from India and Ceylon. The tests were conducted in Ceylon where it was found that among *O. rufipogon* populations there was a tendency for plants from higher altitudes to flower later than those from lower altitudes. *O. perennis* usually flowered later than *O. rufipogon*, and in one population from India most of the plants failed to flower under Ceylon conditions, indicating extreme sensitivity to photoperiod.

1592 *Narise, T. Observations on flowering and seed development in a wild rice species,* Oryza rufipogon (O. sativa spontanea) *in Ceylon.* (*pp. 42–44*).

O. rufipogon populations collected in Ceylon are compared with indigenous and imported cultivars for length of time during which the flowers remain open and the time of flower opening. *O. rufipogon* and indigenous cultivated varieties differed little in the first character but the flowers of imported varieties stayed open for a slightly longer period. The wild species showed a marked delay in flowering on cloudy or rainy days while cultivars were less affected by the weather. In *O. rufipogon*, kernel development was completed about 2 weeks after flowering.

1593 *Katayama, T. & Oka, H.-I. Photoperiodic responses of* Oryza *species.* (*pp. 44–46*).

Almost all of the wild species tested were found to be sensitive to photoperiod, although an insensitive strain was found in each of *O. alta*, *O. officinalis* and *O. minuta*. All tested varieties of *O. glaberrima* (cultivated) were sensitive. It is suggested that sensitivity may be of selective advantage in wild rice species. Critical day length for wild strains ranged from 12 to 13·5 hr. and was positively correlated with latitude.

1594 *Oka, H.-I., Hu, C.-W. & Chang, W.-T. Variation in photoperiodic sensitivity among and within populations of* Oryza perennis *and other wild* Oryza *species.* (*pp. 47–48*).

Grains of wild rice species collected from India and Thailand were sown in May and again in June at the Taiwan Provincial Agricultural College, Taichung. Populations of *O. sativa* var. *spontanea* showed a wide range of variation in sensitivity to photoperiod while *O. perennis* populations were relatively uniform in this respect, variation in heading date being chiefly due to variation in the critical day length. The response of *O. ridleyi* was similar to that of *O. perennis*, while *O. officinalis* was insensitive.

1595 *Katsuya, K. Susceptibility of wild and foreign cultivated rice to blast fungus* Piricularia oryzae. (*pp. 48–49*).

Fourteen strains of 9 wild species, 10 imported cultivars (*O. sativa*) and 3 Japanese cultivars were tested for resistance to *P. oryzae* strains P–2 and 54–04 by spraying and by inoculation. Among the wild strains *O. australiensis* was very susceptible to both fungal strains. *O. officinalis* (?), *O. eichingeri* (?), *O. latifolia* and *O. breviligulata* (?) exhibited resistance to P–2 when sprayed and resistance or moderate susceptibility when inoculated; they were resistant to 54–04 when inoculated. *O. subulata* was moderately susceptible to the P–2 strain and resistant to the 54–04 strain. *O. perennis, O. sativa* var. *fatua* and *O. sativa* strains showed wide intervarietal differences.

1596 *Katsuya, K. Susceptibility of chlorophyll mutants of einkorn wheat to stem and leaf rust,* Puccinia graminis *and* Puccinia triticina. (*pp. 49–50*).

[Cf. 286].

1597 *Takenaka, Y. Cytogenetic studies of the genus* Nicotiana *XI.* (*pp. 50–51*).

Meiosis was studied in (1) *N. knightiana* ($n = 12$) x *N. tabacum* ($n = 24$), (2) $4x$ *N. tabacum* ($n = 48$) x *N. benavidesii* ($n = 12$), and (3) $4x$ *N. tabacum* x *N. langsdorffii* ($n = 9$). In (1) the number of bivalents at metaphase I ranged from 0 to 5 with the mode at 0. Because of the small numbers of bivalents it was difficult to determine whether chromosome affinities were allosyndetic between the genomes of the parents or autosyndetic between the genomes of amphidiploid *N. tabacum.*

The total number of bivalents and trivalents observed in PMCs of (2) was 24; the number of trivalents ranged from 0 to 6 with the mode at 2. It is suggested that "the affinity between homologous chromosomes may in this hybrid be saturated by the presence of two chromosome sets of *N. tabacum*". The same interpretation is given of the low number of trivalents observed in (3) where the total number of bivalents and trivalents was 24, with the number of trivalents ranging from 0 to 5 with the mode at 1.

1598 *Furusato, K. Development of seeds and embryos in three crosses between diploids and artificial tetraploids.* (*pp. 54–55*).

Seed and embryo development was studied in diploid ♀ x induced autotetraploid ♂ crosses in (1) *Nicotiana tabacum,* (2) *Citrullus vulgaris,* and (3) *Citrus* sp. In (1), pollen germination was retarded and some of the grains showed abnormal growth, producing twisted pollen tubes. After fertilization the egg cell started to divide, but 30 days later only an undifferentiated mass of tissue had been produced. Endosperm development was also defective. The same phenomena were observed in (2), although when the diploid and tetraploid parents were represented by *Citrullus colocynthis* and *C. vulgaris,* respectively, embryo and seed development was normal. In (3) the monoembryonic varieties produced only aborted seeds while in polyembryonic varieties a few small nucellar embryos were developed. The poor growth of the nucellar embryos may have been due to defective endosperm development.

1599 *Matsumura, S., Mochizuki, A. & Nezu, M. Frequency of 3x seedlings in several "triploid" varieties of sugar beets.* (*pp. 56–57*).

The frequency of $2x$, $3x$ and $4x$ seedlings in seven European "triploid" varieties was determined. Polyrave and Trirave, both from the Netherlands, gave the highest proportions of triploid seedlings, with 66·4% and 80% respectively.

1600 *Doida, Y. Heterostyly and pollen grain number in buckwheat.* (*pp. 57–58*).

In short-styled flowers the number of pollen grains per pollen sac ranged from 24 to 44 with the mode at 32, while in long-styled flowers the number ranged from 32 to 68 with the mode at 48.

1601 *Sakai, K.-I. & Iyama, S.-Y. Further studies on cherry-red leaf in tobacco.* (*pp. 60–61*).

It was confirmed that degree of postharvest reddening is under genetic control although it was not possible to estimate the number of genes involved. A correlation coefficient of 0·234 was found between degree of reddening and quality of the leaf.

1602 *Oka, H.-I. & Sakai, K.-I. Inheritance of competitive ability in rice.* (*pp. 62–63*).

The inheritance of competitive ability was studied in the F_2 and F_3 of a cross between Kinoshita glutinous rice (*japonica*) and U-koh (*indica*) using Yaeho as the tester strain. The results indicate that competitive ability is controlled by Mendelian factors although the number of factors involved could not be estimated because of the great variance in the F_3 lines.

1603 *Sakai, K.-I. & Narise, T. Studies on the breeding behavior of wild rice* (Oryza rufipogon *and* Oryza perennis). (*pp. 64–65*).

Considerable variation in percentage outbreeding was found among populations of *O. rufipogon* (*O. sativa* var. *spontanea*) and *O. perennis* collected mainly from Ceylon. An average value of 25–30% is reported for both species.

1604 *Sakai, K.-I. & Narise, T. Genetic variability in wild populations of* Oryza perennis *and* O. rufipogon. (*pp. 66–70*).

Eight populations of *O. perennis* and 12 of *O. rufipogon* (*O. sativa* var. *spontanea*) collected mostly from India were analysed with respect to length and width of the spikelets. Variations between species, between populations within species and within populations were all statistically significant. *O. rufipogon* has, in general, slightly longer and wider spikelets than *O. perennis*. Heritability values were calculated for each population and their geographical distribution studied. Populations from Orissa were found to have lower heritability values than those from other regions. A study of environmental and genetic correlations between the two characters showed the former to be generally insignificant and the latter to vary from population to population.

1605 *Sakai, K.-I. & Narise, T. Variation in anthesis of wild rice populations* (Oryza rufipogon *and* Oryza perennis). (*pp. 70–71*).

The number of days from sowing to anthesis was determined in several populations of *O. rufipogon* (*O. sativa* var. *spontanea*) and *O. perennis*. While flowering in *O. rufipogon* populations was markedly earlier than in *O. perennis*, wide interpopulation and intrapopulation variation was observed in both species.

1606 *Sakai, K.-I. & Pinto, M. E. R. Genetic studies on seed size in rice hybrids.* (*pp. 72–73*).

The length and width of seeds from six F_2 populations from crosses involving eight varieties were measured. Heritability values were found to be fairly high, with those for seed length rather higher than those for width. Among the parent varieties Ptb–16, Sigadis and Mas M–24 were similar phenotypically, but the heritability values of their hybrid progenies show that while the first two are similar genetically the last variety is genotypically distinct. Genetic correlation between seed length and width was low while environmental correlation was high.

1607 *Iyama, S.-Y., Morishima, H. & Oka, H.-I. Inheritance of size and shape of grains in rice.* (*pp. 73–75*).

The inheritance of grain size was studied in the F_2 and F_3 of two *japonica* x *indica* crosses: Kinoshita glutinous rice x U–koh (cross 1) and Norin 18 glutinous rice x red rice (cross 2). Tabulated data on additive and nonfixable genetic variance and environmental variance in grain length, width and length-width ratio are given. The observed variances gave a good fit with expected variances in cross 1, but in cross 2 standard deviations were rather large; this is thought to be due to changes in the segregation ratio caused by gametic selection in the latter since partial sterility appeared in the F_1 of this cross. Some indications of linkage are reported among genes controlling the length-width ratio in cross 1, and among those conditioning grain length in cross 2. It was not possible to estimate the number of genes involved. Considerable variation was found in the components of environmental variances due to grains, plants and plots.

1608 *Kimura, M. A maximum principle in the genetical theory of natural selection.* (*pp. 83–84*).

[Cf. XXVIII, 3688].

1609 *Kimura, M. A gene frequency cline determined by selection and migration.* (*pp. 84–86*).

A population occupying a linear habitat where dominant individuals (*AA* and *Aa*) are advantageous on one side of a neutral point and recessive (*aa*) individuals are advantageous on the other side is considered. If the range of migration of each individual per generation is small compared with the total range of distribution, a gene frequency cline may be formed. On the assumption that the selective advantage (or disadvantage) of dominants over recessives at any point is proportional to the distance of that point from the neutral point, numerical values were obtained for the selective advantage of $u(x)$ which represents the frequency of dominant gene A at a distance x from the neutral point. The range of x values chosen was $-11{\cdot}4$ to $+3{\cdot}6$ with intervals of 0·1.

1610 *Kimura, M. Conflict between self-fertilization and outbreeding in plants.* (*pp. 87–88*).

An expression is formulated for determining the rate of change per generation in the frequency of an outbreeding allele A_1 in plants heterozygous for the inbreeding *v.* outbreeding character. The rate was found to depend on the amount of inbreeding depression, D, resulting from self fertilization, being positive or negative according as $D - \frac{1}{2}$ is positive or negative. If however $D = \frac{1}{2}$, an intermediate gene frequency will be held in neutral equilibrium. Since, on the average, half of the heterozygous loci will become homozygous after one generation of selfing, the condition $D = \frac{1}{2}$ will be realized if the population contains recessive deleterious genes amounting to one lethal equivalent per gamete. Thus it is concluded that an outbreeding species is immune to "the attack of self-fertilizing genes" if it contains recessive deleterious genes amounting to more than one lethal equivalent per gamete or two per zygote.

1611 *Ogawa, Y. & Shimotuma, M. Bitter substances in the fruits of F_1 progenies from crosses of* Citrullus colocynthis. *(pp. 93–94).*

The F_1 progenies from crosses of *C. colocynthis* (2*x*) with seven varieties (2*x* and 4*x*) of *C. vulgaris* were evaluated for citbittol content of the ripe fruits. Although the water melons contain no bitter substances their hybrid progenies showed wide varietal differences in both concentration and proportions of citbittols.

1612 *Fujii, T. Radiosensitivity in plants. (pp. 114–17).*

The LD–50 γ-ray dosages of 43 cultivated plant species and varieties were determined [cf. XXIX, 3502]. The radiosensitivity of 5 mutants (3 chlorophyll-deficient, 2 morphological) of *Triticum monococcum* var. *flavescens* to X and γ rays was studied. Decreases in germination rate, survival rate and fertility in the X_1 mutants were similar to those observed in irradiated normal plants, but the chlorophyll-mutation rate and viability percentage in the X_2 were lower in the mutants. No back mutation occurred.

1613 *Nezu, M. Relation of ploidy to radiation effect. (pp. 119–20).*

An examination of diploid, tetraploid and hexaploid *Triticum* species subjected to γ-ray dosages of 20, 30 and 40 kr. for 18 hr. showed the percentage of PMCs with meiotic irregularities (mostly reciprocal translocations) to increase with increase in ploidy; an increase in the number of multivalents was also noted, particularly in 6*x* species. The number of chromosome breaks per cell increased almost linearly with dosage within the groups. Seed fertility decreased with increasing dosage; the 2*x* species were particularly susceptible in this respect, followed by 6*x* and then 4*x* species.

1614 *Matsumura, S. Genetic effects of β and γ-radiation on einkorn wheat. (pp. 120–21).*

Seeds of *Triticum monococcum* var. *flavescens* were soaked for 2 days in solutions of various concentrations of P^{32} and I^{131}, and X_1 and X_2 plants were compared with those from seeds soaked in water for the same period and exposed to a range of γ ray dosages. X_1 plants with white and yellow stripes were often found, especially after P^{32} treatment. The frequency of ears with chromosome aberrations in X_1 plants was strikingly high after γ irradiation. The frequency of chlorophyll mutations in the X_2 increased with increase in dosage; the majority of chlorophyll mutants after β irradiation were *albina*, *xantha* and *viridis*, while with γ irradiation *albo-viridis*, *virido-albina* and *basi-viridis* were most often observed. It was found that the effects of β irradiation from 0·2 mc./g. P^{32} solution and 0·8 mc./g. I^{131} solution, correspond to those of 2·5 kr. γ irradiation.

1615 *Matsumura, S. Genetic effects of thermal neutrons on wheat. (pp. 121–23).*

Triticum monococcum var. *flavescens* was most sensitive to thermal neutrons, and *T. durum* was most resistant. No significant difference was found between *T. durum* and *T. vulgare.*

1616 *Fujii, T. Genetical analysis of a few chlorophyll mutants in einkorn wheat induced by radiation. (pp. 123–25).*

Crosses of *basi-viridis* II with other chlorophyll-deficient mutants are discussed [cf. XXX, 2494]. In crosses of *striata* with *chlorina*, *basi-viridis* I and II, slender and early, it was found that *striata* and double recessive plants segregated only from plants with $1_{IV} + 5_{II}$ and not from plants with the normal seven bivalents, indicating that the *striata* gene must be located on one of the chromosomes involved in the reciprocal translocation.

1617 *Rajan, S. S. Radiation-induced mutation of the self-incompatibility gene in* Brassica. *(pp. 124–25).*

A preliminary report is given of attempts to induce mutation of the self-incompatibility gene, *S*, in some *Brassica* species by means of X and γ irradiation of mature pollen grains and flower buds at various stages of development. No mutational effect was observed in the case of mature pollen grains, although considerable stimulation was noted in the development of fruits, mostly with very few seeds.

Seeds with 100% viability were formed after self pollination of flowers opening on the fourth day after irradiation and later. A steady decline in seed set occurred in flowers irradiated at earlier stages of development; buds that were at the early-prophase to anaphase I stages during irradiation produced no fertile pollen.

It is assumed that each seed formed is due to the mutation of a single self-incompatibility gene. Alternative explanations put forward are (1) pseudofertility, (2) mutation of modifiers, specific or nonspecific in reaction, and (3) physiological weakening or destruction of the incompatibility reaction without genetic consequences. If the original assumption is correct, then the fact that mutations could be induced at the tetrad stage would lend further support to the hypothesis that the pollen reaction in this material is under sporophytic control.

1618 *Nezu, M. A simple method for the determination of chromosome number in rice.* (*p. 138*).

Good results were obtained by fixing root tips in glacial acetic acid before squashing and staining by the Feulgen method. The following chromosome numbers are reported: *Oryza ridleyi*, $2n = 48$; *O. australiensis*, 24; and *O. alta* (?), 48.

1619 LAMPRECHT, H.
Über Blattfarben von Phanerogamen. (**On the leaf colours of phanerogams**).
Agri hort. genet., Landskrona 1960 : **18** : 135–68.

After a survey of the effects of environment and genetic background on the expression of colour mutations, the classification of genetically determined colours into the following three groups is proposed: (1) the *chlorovegetus* group of vigorous chlorophyll types; (2) the *chlorodefectio* group of types in which the chlorophyll apparatus is somewhat defective; and (3) the anthocyanin group, comprising anthocyanin-containing forms of the above two types. Group 1 includes the subgroups *chloraequalis* and *chlorinaequalis*, the former having a uniform genetical constitution for all the green parts of the plant while the latter comprises biotypes in which certain normally green parts develop some other genetically determined colour. In group 2, the *chlorohom* subgroup has a uniform colour throughout development, the *chlorodiv* subgroup has at least two distinct colours throughout development, the *chloromut* subgroup changes colour during the course of growth and the *chlorofract* subgroup suddenly changes colour at a certain stage of growth. Examples of all the types are given, and 21 colours are distinguished and designated by Latin names in the *chlorohom* subgroup.

1620 CICIN, N. V.
(**Distant hybridization**).
Priroda (Nature), Leningrad 1960 : No. 6 : 7–14. [Russian].

Some improved varieties of field crops, including wheat and industrial and horticultural plants, and of forest trees obtained by distant hybridization in the USSR in recent years are listed [cf. XXVIII, 3966]. The role of hybridization in evolution, interspecific and intergeneric crossability and related topics are discussed. The concept of evolution by interspecific conversion is rejected.

1621 ŽUKOVSKIJ, P. M.
(**Heterosis in economic plants**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 8 : 9–19. [Russian].

The breeding methods by which heterotic hybrids of lucerne, red clover, cotton, sugar beet, hop, red pepper, castor-oil plant, sunflower, fruit trees, strawberry, vine, forest trees, carrot, onion, asparagus, spinach, cucumber, tomato and other plants may be obtained are described. Generally speaking the most effective method of breeding for heterosis is the production of inbred lines for crossing and the transfer of cytoplasmic male sterility to one of the components previously to crossing.

Evolutionary trends in angiosperms suggest that male-sterile forms may be found in most cultivated plant species. The evolution of angiosperms is seen as proceeding from plants with bisexual flowers to those with unisexual flowers. The evolutionary expediency of this phenomenon lies in the changes from homozygous to heterozygous states whereby genotypical variability, vitality and survival of a species are safeguarded. The change from one sexual type of flower to another is envisaged as gradual and resulting from the reduction of ♀ or ♂ elements of the flower. Self pollination of monecious or hermaphrodite flowers is to a considerable degree facultative. Even in such self-pollinating plants as wheat, oat, barley, pea, soya bean, *Arachis*, poppy, cotton and tomato cross pollination is common. The self-pollinating plants with a tendency towards cross pollination are characterized either by protandry or protogyny or by slower growth of self pollen on the stigma. All these characteristics can be utilized in breeding heterotic hybrids.

1622 Neue Kulturpflanzensorten für den Anbau. (**New varieties of cultivated plants for cultivation**).
Dtsch. Landw., Berl. 1960 : **11** : 391–93.

Oats. Hadmerslebener Stützfruchthafer [Hadmersleben Companion Crop oat] is a medium-late variety suitable as a companion crop for leguminous plants; it has good standing capacity and the stem length is average.

Barley. Hadmersleben 3300/51 and Kleinwanzleben 14705 are two-rowed spring barleys resembling Freya and Elsa in time of ripening and height. Both give good yields of grain and straw and have fine glumes and good malting properties; they are suitable for combine harvesting. Hadmersleben 3300/51 is adapted to light, medium and good soils. Kleinwanzleben 14705 has performed well in the maritime region of Rostock and on medium and light soils elsewhere and it should replace the variety Saale in some districts. It is resistant to loose smut and shows low or medium susceptibility to powdery mildew.

Phacelia. At Bernburg *Phacelia* has been developed into a fodder crop. It has a short vegetative period and may be grown as a summer stubble crop. It withstands temperatures of — 7° C. in autumn and is not demanding in its soil requirements.

Rape. Gross-Lüsewitz 52/1635 is a winter variety tolerant of late sowing. When sown at the end of August or beginning of September it surpasses Lembkes Malchow by about 15% in yield of seed and oil; if sown later its yield is equal to that of Lembkes Malchow after an earlier sowing. The best yields are obtained on good light soils of diluvial origin. Standing capacity and winter hardiness are good in this variety. Gülzow 603 is also tolerant of late sowing; when sown at the end of August or the beginning of September, its seed yield is 8% and its oil yield 10% higher than that of Lembkes Malchow. The resistance to shattering and standing capacity are medium to good and the winter hardiness is also good.

1623 Nové odrůdy hospodářských plodin. **(New varieties of economic crops).**
Za Socialist. Zeměd. 1958 : **8** : 1026–39.

In addition to the varieties described below, others are mentioned which have been reported elsewhere [cf. XXV, 2183 and XXX, 216].

Minor crops. New varieties of fennel and some medicinal plants are described.

Oil crops. The Opava research Station has submitted an early winter rape to the state trials. This station has also selected an improved black mustard, Kroměříž 202/1 which is early and resistant to lodging; it has an oil content of 35–40%.

1624 Rassenlijst voor landbouwgewassen 1961. **(Varietal list of agricultural crops, 1961).**
Zaadbelangen 1960 : **14** : p. 455.

A list of varieties of mangel, turnip, red clover, fodder lupin, grasses, cereals, pulses, flax and potato to be admitted to the 1961 official varietal list is given [cf. XXX, 4538].

1625 MOHANTY, R. N.
Morphological and cytological effects of radioactive phosphorus and radioactive sulphur in some cereals and legumes.
Indian J. Genet. 1960 : **20** : 136–43.

Data on pollen sterility and chromosome aberrations induced by seed treatment with P^{32} and S^{35} are presented. The frequency of aberrant cells in isotope-treated root-tip cells of wheat was considerably greater than in similarly treated cells of rice.

Dicentric and sticky bridges were observed in root-tip cells of P^{32}-treated seedlings of *Cyamopsis tetragonoloba* and *Trifolium alexandrinum.* A high percentage (48%) of aberrant cells was observed in root tips of *Vicia faba* treated with S^{35}. Abnormalities recorded included dicentric bridges, sticky bridges, and chromosome and chromatid breaks.

1626 TER-AVANESYAN [TER-AVANESJAN], D. V.
The effect of the quantity of pollen used on the inheritance of characters.
Indian J. Genet. 1959 : **19** : 30–35.

Different amounts of pollen were applied to the stigmas of emasculated flowers of the cotton variety C–15 and the wheat variety Graecum 433. An analysis of variability in the progenies resulting from these pollinations indicated that, in cotton, a minimum of 600–1000 pollen grains per stigma is required to maintain the average type of the variety. When 100 or less pollen grains are applied, there is marked variability in characters such as plant height, 100-seed weight, number of bolls per plant and yield per plant. In the wheat study, 100 pollen grains per stigma resulted in progeny corresponding to the average type while 20 or less grains led to marked variability.

In another trial on the effects of limited pollination, it appeared that pollen from C–460, a green-leaved cotton, was more successful in effecting fertilization in emasculated flowers of that variety than was pollen of a red-leaved variety.

It is pointed out that plants normally produce a far larger quantity of pollen than appears to be required to maintain the type. The excess is thought to represent a safety device which has developed through natural selection and is responsible for the occurrence of normal generative reproduction. It is concluded that: (1) the process of sexual reproduction does not consist of the act of double fertilization alone since the surplus pollen tubes penetrating into the ovary also play an important part in the formation of the zygospore; (2) pollen grains are genetically heterogeneous, since with rare exceptions there are no strictly self-pollinated plants in nature; and (3) pollination with a limited quantity of pollen does not always lead to progeny lacking in vigour.

1627 Ross, H.
German Botanical and Agricultural Expedition to the Andes 1959.
Pl. Introduct. Newslett. FAO 1960 : No. 8 : 1–5. (Mimeographed).

An account is given of an expedition sponsored by the Max Planck Institute for Plant Breeding, Köln-Vogelsang, and other bodies. Its chief aims were the collection of *Solanum* (sect. *Tuberarium*), *Phaseolus*, *Lupinus* and *Lycopersicon*.

1628 Singh, H. B. & Mital, S. P.
Plant introduction reporter—III.
Bull. Indian Counc. Agric. Res., New Delhi 1960 : No. 84 : Pp. 27.

Information is provided on the origin and chief characteristics of foreign and indigenous collections made during 1960 and studied at the Indian Agricultural Research Institute and other stations. As in the previous lists, cereals, pulses, oil plants, vegetables and several other kinds of crops are included [cf. XX, 2194 and XXVII, 2666].

32. Deutsche Pflanzenschutz-Tagung der Biologischen Bundesanstalt für Land- und Forstwirtschaft in Hannover, 6.–10. Oktober 1958. (**32nd German Plant Protection Congress of the Biological Federal Institute for Agriculture and Forestry in Hannover, 6–10 October 1958**).
Mitt. biol. BundAnst. Land- u. Forstw. Berlin-Dahlem 1959 : **97** : Pp. 239.

1629 *Brandenburg, E., Eibner, R. & Tostmann, R. Untersuchungen über die Eisenfleckigkeit-Pfropfenbildung der Kartoffel als bodengebundene Viruskrankheit.* (*Investigations on internal rust spot or sprain of potato as a soil-bound virus disease*). (*pp. 36–51*).

[Cf. XXX, 4091].

1630 *Bode, O. Untersuchungen über das Y-Virus der Kartoffel* (*Tabak-Rippenbräune-Stämme*). [*Investigations on the Y virus of potato* (*tobacco brown-vein strains*)]. (*pp. 52–60*).

Varieties were tested by planting healthy tubers in rows between infected plants in the field. Forty of the eighty varieties tested showed good resistance; Maritta and Voran were highly resistant.

Abstracts of papers accepted for presentation at the fifty-second annual meeting of the American Phytopathological Society, Green Lake, Wisconsin, August 28, 29, 30, 31, 1960.
Phytopathology 1960 : **50** : 627–60.

1631 *Al-Sohaily, I. A. & Mankin, C. J. Races of head smut of sorghum.* (*p. 627*).

Seven collections of *Sphacelotheca reiliana* from Texas, New Mexico, California and India were used to inoculate sorghum, Sudan-grass and broomcorn varieties. The results indicate that the collections comprise 3 or 4 races of the pathogen.

1632 *Ashworth, L. J. (Jun.), Lahr, K. A. & Collins, R. J. Pathogenic specialization of* Helminthosporium sativum. (*p. 627*).

Based on the differential susceptibilities of Westar wheat, Combine 7078 sorghum, Alamo oat and New Nortex oat, eleven isolates of *Helminthosporium sativum* (*Cochliobolus sativus*) from wheat are classified into 6 pathogenic groups.

1633 *Browning, J. A. Altering the effect of oat rust resistance genes by certain physical means.* (*p. 630*).

Stem-rust resistance was broken down in leaves detached from resistant oat varieties 1–9 days after inoculation, and in the distal parts of leaves [presumably attached] scalded along a narrow transverse band. Resistance to stem and crown rust was also broken in varieties severed at the second node and maintained root-free.

1634 *Browning, J. A. Induced susceptibility of wheat and barley to oat crown and stem rust fungi.* (*p. 630*).

Ten wheat and thirteen barley varieties were inoculated with races of *Puccinia graminis* var. *avenae* and *P. coronata* var. *avenae* to which they were immune or highly resistant. Primary leaves were detached or scalded [cf. 1633] one day after inoculation. A susceptible reaction was exhibited by all detached leaves and by the distal parts of all scalded leaves.

1635 *Cook, A. A. A mutation for resistance to potato virus Y in pepper.* (*p. 632*).

A single plant (YRP10) of a commercial variety susceptible to potato virus Y (PVY) was not infected by repeated mechanical inoculation. Tests on the F_1, back-cross and F_2 progenies of crosses with three susceptible varieties showed the plant to be homozygous for a single recessive gene. YRP10 progenies exhibited imperfect localization of resistance (l^i) to tobacco mosaic virus (TMV) but were susceptible (et^{a+}) to tobacco etch virus (TEV). "With the demonstration of resistance to PVY and susceptibility to TEV in the YRP10 progeny plants, spurious pleiotropism cannot be considered tenable as an explanation for the association of resistances to PVY and TEV in some peppers, and the gene designation ey^a must be regarded as invalid".

1636 *Cook, R. J. Lesion type as a means of evaluating barley lines for resistance to* Helminthosporium sativum. *(p. 632).*

Individual *Helminthosporium sativum* (*Cochliobolus sativus*) lesions on susceptible varieties tested appeared as necrotic areas, each with a chlorotic halo, whereas lesions of resistant varieties were characterized by restricted necrotic spots with no halo. Although these two groups were usually indistinguishable under greenhouse conditions, lesion differences were definite and consistent when inoculated seedlings were incubated for 40 hr. at 20° C. with moisture added as fine droplets prior to inoculation and again after 16 hr.

1637 *Deese, D. C. & Stahmann, M. A. Role of pectic enzymes in susceptibility and resistance to* Fusarium *and* Verticillium *wilts of plants. (p. 633).*

The results of experiments with resistant and susceptible tomato and banana plants suggest that resistance to *Fusarium* and *Verticillium* wilts may be due to a suppression of the formation of fungal pectic enzymes by factors in the resistant tissue, and that susceptibility may be associated with greater pectic enzyme formation.

1638 *Diachun, S. & Henson, L. A population of self-fertile red clover necrotic-spotting with a strain of bean yellow mosaic virus. (p. 633).*

A self-sterile red clover plant of KyC39 which exhibits a necrotic-spotting reaction to bean yellow mosaic virus (BYMV) isolate 204–1, and is known to be heterozygous for reaction (*Nn*), was fertilized by pollen from an autogamous self-fertile plant, KyCA2, which is known to be homozygous recessive (mottling reaction). From the F_2 progeny a plant (KyC39A2–2–4) was selected which is homozygous for necrotic spotting, self-fertile and partially autogamous. Seventy plants developed from seed of this plant were inoculated with BYMV isolate 204–1 and all gave a necrotic spotting reaction; this population has been designated KyBYMV Nec SF 1959.

1639 *Garrett, W. N. Production of new races of* Puccinia graminis *var.* tritici *by tissue transplants. (p. 636).*

Two of the four new isolates obtained from a mixed culture of orange 11 and gray-brown 121 are said to be pathogenically unlike any previously known race of *P. graminis* var. *tritici.*

1640 *Graham, J. H. Rapid screening of alfalfa for resistance to* Corynebacterium insidiosum *by inoculating petioles. (p. 637).*

Lucerne varieties could be rapidly screened for resistance to the above pathogen by inoculating petioles near the tips of 6–8 week old seedlings or of succulent shoots.

1641 *Grant, B. R. & Kuc, J. On the resistance of tomato varieties to* Cladosporium fulvum. *(p. 637).*

A comparison of growth rates of *C. fulvum* race 1 on extracts from susceptible and resistant varieties of *Lycopersicon esculentum* and *L. pimpinellifolium* 'Red Current' [*sic*] suggests the presence of inhibitory substances in the resistant varieties. While the inhibitory activity of Vinequeen extracts was destroyed by autoclaving and by freezing and thawing, extracts from *L. pimpinellifolium* did not lose their inhibitory activity when so treated.

1642 *Guzmán N., J., Thurston, H. D. & Heidrick, L. E. Nature of partial resistance of three species of potatoes to* Phytophthora infestans. *(p. 637).*

Resistant and susceptible clones of *Solanum tuberosum*, *S. andigenum* and *S. phureja* were inoculated with *Ph. infestans* race 0 and placed in a moist chamber. The time required for the production of sporangia was found to be an accurate indication of field resistance.

1643 *Hagedorn, D. J. Testing commercial pea varieties for reaction to* Fusarium *root rot,* Fusarium solani *f.* pisi. *(p. 637).*

A description is given of the technique considered most satisfactory. Of 280 varieties tested, no immune or highly resistant strains were found although a few were tolerant of the disease; the best of these was Wando.

1644 *Henson, L. & Stokes, G. W. A technique for determining the reaction of seedling plants to* Thielaviopsis basicola. *(p. 638).*

To determine seedling reaction in small-seeded forage legumes, the seedlings were grown in vermiculite which was saturated at the time of seeding and again 3 days later with a suspension of endoconidia and mycelium in a 1/3N Hoagland solution. Disease readings were made 14–30 days after inoculation. This method has been used satisfactorily with one or more species of the following genera: *Glycine, Lespedeza, Lotus, Lupinus, Phaseolus, Pisum, Trifolium, Vicia* and *Vigna.*

1645 *Kendrick, E. L. A solopathogenic line of* Tilletia caries. (*p. 641*).

A diploid strain, 392–1, was isolated from race T–16 of *T. caries.*

1646 *Kendrick, E. L. & Holton, C. S. Compatibility relationships between monosporidial isolates of* Tilletia caries *and* T. contraversa. (*p. 641*).

Although unable to fuse with each other, 5 lines of *T. contraversa* fused with both plus and minus strains of *T. caries.* The *T. contraversa* strains crossed more successfully as "minus" than as "plus" lines.

1647 *Kimble, K. A. & Grogan, R. G. Resistance to* Phytophthora *root rot in pepper.* (*p. 642*).

Of 613 lines, varieties and plant introductions screened for reaction to *Ph. capsici,* the PI selections 187331, 123469, 201232, 188476 and 201234 were most resistant. The best selection, PI201234, had a 95% survival rating 30 days after inoculation.

1648 *Kline, D. M. Induced color mutants in* Rhynchosporium secalis. (*p. 642*).

Spores of 16 pathogenic biotypes of *Rh. secalis* were exposed to ultraviolet rays to obtain colour markers for pathogenicity studies. Eighty colour mutants were obtained, none of which reverted to the wild type during 5–8 mycelial transfers. When seedlings of a barley variety susceptible to the original biotypes were inoculated with the mutant strains, 45 mutants proved to be pathogenic and 35 nonpathogenic.

1649 *Kline, D. M. Variation in pathogenicity in* Rhynchosporium secalis. (*p. 642*).

Evidence of physiological specialization in *Rh. secalis* was obtained from pathogenicity tests of 44 isolates on 35 of the principal winter barleys grown in the USA.

1650 *Kollmer, G. F. & Larson, R. H. Host range, properties, varietal reaction and resistance in relation to isolates of potato virus F.* (*p. 642*).

Resistance to virus F was found in *Solanum chacoense* and in several interspecific hybrids involving this species.

1651 *Luke, H. H. & Pfahler, P. L. Inheritance and linkage studies of a derived Victoria-type crown rust resistance and Victoria blight.* (*p. 644*).

About 25 million seedlings of the oat variety Fulgrain, which is susceptible to Victoria blight and carries the Victoria type of crown-rust resistance, were screened. Seventy-four blight-resistant seedlings were isolated and two of these carried crown-rust resistance similar to that of Fulgrain. The two mutants were identical to Fulgrain in reaction to races 202 and 203, but were more susceptible to races 205 and 290. The Victoria-type necrosis was exhibited by both mutants to all 4 races. Inheritance studies on one mutant and Fulgrain indicated that blight resistance was a simply inherited recessive character. Reaction to crown-rust race 205 was also simply inherited, with the mutant character dominant or partially dominant. Linkage data obtained from the classification of F_2 genotypes on the basis of F_3 analysis indicated some crossing over between the two loci.

1652 *Moseman, J. G. Genes conditioning pathogenicity in* Erysiphe graminis *f. sp.* hordei *on barley variety Atlas 46.* (*p. 647*).

Pathogenicity tests of 68 haploid cultures from the cross CR3 x CAN12 of *E. graminis* f. sp. *hordei* indicated that two genes condition pathogenicity on Atlas 46. One of the genes conditioned pathogenicity on Atlas (one of the parents of Atlas 46) and the other conditioned pathogenicity on Goldfoil and Stephan. The two genes were inherited independently. "If the hypothesis is valid that for each gene conditioning pathogenicity in the pathogen there is a complementary gene conditioning reaction in the host, then Atlas 46 has two genes conditioning resistance to these cultures of *E. graminis* f. sp. *hordei.* Atlas would have one of these genes, and Goldfoil and Stephan the other".

1653 *Moseman, J. G. Inheritance of 5 genes conditioning pathogenicity in* Erysiphe graminis *f. sp.* hordei *on barley.* (*p. 647*).

The relationship of 5 genes conditioning pathogenicity in *E. graminis* f. sp. *hordei* was studied in pathogenicity tests of 110 haploid progenies from crosses of CR3 with CAN12 and 59–11 with 59–20. One gene was found to condition pathogenicity on each of the barley varieties Kwan, Goldfoil, Nepal, Peruvian and Chevron. The three genes for pathogenicity on the first three varieties were inherited independently of each other and of the other two genes. Several physiological races not previously identified in North America were isolated from these cultures.

1654 *Nelson, R. R. The relationship of conidial morphology and interspecific fertility in the genus* Helminthosporium. (*p. 648*).

Fourteen species of *Helminthosporium*, of which 6 are known to have *Cochliobolus* perfect stages, fell into five classes based on size and shape of conidia. Of the interspecific crosses made so far, 12 produced viable ascospores and 11 produced sterile asci. Nine of the fertile crosses involved species with the same conidial morphology while nine of the sterile combinations were between species with different conidial morphology.

1655 *Nelson, R. R. & Hebert, T. T. The inheritance of pathogenicity and mating type in crosses of* Helminthosporium carbonum *and* Helminthosporium victoriae. (*p. 649*).

From crosses of *Helminthosporium victoriae* (*Cochliobolus victoriae*) with races 1 and 2 of *H. carbonum* (*C. carbonus*), pathogenicity was found to be conditioned in these species by a single gene inherited independently of mating type.

1656 *Ross, A. F. & Bozarth, R. F. Resistance induced in one plant part as a result of virus infection in another part.* (*p. 652*).

In experiments with *Nicotiana tabacum* 'Samsun' and tobacco mosaic and tobacco necrosis viruses, localized infection of the lower leaves induced resistance in the upper leaves and *vice versa*. Similarly, inoculation of half leaves induced resistance in the opposite virus-free halves. Resistance reached a maximum in 7 days and persisted for at least 20 days.

1657 *Rowell, J. B., Loegering, W. Q. & Powers, H. R. (Jun.). Mutation for pathogenicity in* Puccinia graminis *var.* tritici. (*p. 653*).

A culture of *Puccinia graminis* var. *tritici* (111 x 36#5) known to be heterozygous at 4 loci for pathogenicity, with avirulence dominant, was irradiated with 121 Kr. of 100 Kvp X rays to induce mutations in virulence for physico-chemical study. The tentative genotype of the culture was $P_1p_1P_2p_2P_3p_3P_4p_4$. P_1p_1 with the corresponding gene R_1R_1, which conditions resistance in the host, results in a 0 infection type; P_2p_2 with R_2R_2 a 2 to 3–c; P_3p_3 with R_3R_3, a 2; and P_4p_4 with R_4R_4, a 0. The gene pair R_1R_1 occurs in the wheat varieties Hope XVII, Marquis, Reliance and Kota. In addition, Marquis has R_2R_2, Reliance R_2R_2 and R_3R_3, and Kota R_4R_4. The irradiated spores of culture 111 x 36#5 were screened on Marquis, and 136 cultures were obtained that gave 2 to 3–c infection type. This indicates that P_1p_1 mutated to p_1p_1 and permitted the expression of P_2p_2. Nearly all of these cultures on Hope XVII gave high infection types, on Reliance type 2, and on Kota type 0. Thus, selection of mutants of P_1p_1 to p_1p_1 on Marquis permitted the expression of the three other genes affecting virulence on Marquis, Reliance and Kota, respectively. Some mutant cultures varied from this pattern, indicating that additional mutations occurred.

1658 *Savage, E. J., Clayton, C. W. & Gallegly, M. E. Production of oospores by inter- and intraspecific pairings within the genus* Phytophthora. (*p. 653*).

Compatibility types similar to the A^1 and A^2 types now recognized in *Ph. infestans* were present among isolates of *Ph. capsici* and *Ph. parasitica*; similar types also appear to exist in *Ph. cryptogaea*.

1659 *Schaller, C. W. A survey of the world barley collection for resistance to barley yellow dwarf.* (*p. 653*).

Of 6728 varieties tested, 28 were highly resistant, 34 were resistant, and 55 showed a fair degree of tolerance. Of the 62 resistant and highly-resistant varieties, 60 were introductions from Abyssinia and 2 were of hybrid origin with Abyssinian types in their parentage.

1660 *Schroeder, W. T., Provvidenti, R., Barton, D. W. & Mishanec, W. Temperature effecting a reversal of dominance in the resistance of* Pisum sativum *to bean virus 2.* (*p. 654*).

Resistance to bean virus 2 is conferred by a single recessive gene. Symptom expression in plants heterozygous for resistance however was found to be determined by temperature, phenotypic resistance being dominant at air temperatures of 65° F. or below, and recessive at 80° F. or above; between these two temperatures symptom expression is delayed. This type of temperature effect was not observed in homozygous resistant or homozygous susceptible plants, and can therefore be used to separate heterozygotes from them. Identical results were obtained with another strain of bean virus 2, similar if not identical to pea virus 2.

1661 *Sewell, W. D. & Caldwell, R. M. Use of benzimidazole and excised wheat seedling leaves in testing resistance to* Septoria tritici. (*p.* 654).

Uniform and highly reproducible results were obtained when excised first leaves were placed with their cut ends in a 40 p.p.m. benzimidazole solution, sprayed with a conidial suspension of *S. tritici* in 0·5% gelatin solution, and maintained in a moist condition at 70° F. under 12-hr. day lengths. Resistance under these conditions corresponded well with resistance observed under field conditions.

1662 *Shands, H. L. Sources of crown rust resistance of oats.* (*p. 654*).

Rust-resistant varieties from the USDA World Collection of oats were hybridized for progeny tests at Madison, Wis. and in Puerto Rico. The parents of selections having low rust readings at Madison are listed. Most of the selections proved susceptible to several virulent races in Puerto Rico, but selections from Rodney x CI4795–3, PI174544 x Clintland, and PI174544 x CI4795–15 were resistant to races 216, 264 and 290 in tests in Puerto Rico during 1958–59.

1663 *Skotland, C. B. & Burke, D. W. A virus of wide host range seed-borne in* Phaseolus vulgaris. (*p. 655*).

Symptoms suggestive of common bean mosaic appeared in a field of Columbia Pinto beans resistant to bean virus 1 and 1A. Of the varieties inoculated with the new virus, Topcrop, Idaho Bountiful and Idaho Refugee were immune.

1664 *Smiley, J. H. & Stokes, G. W. Population studies of* Pseudomonas tabaci *in diploid, triploid, and tetraploid* Nicotiana tabacum *plants with different doses of the* Nicotiana longiflora *gene for resistance.* (*p. 655*).

Studies on 3 diploid, 4 triploid and 3 tetraploid plants with respectively, 0, 1 and 2; 0, 1, 2 and 3; and 0, 2 and 4 resistance genes, revealed an inverse relationship between the number of genes present and the size of the bacterial population. A gene dosage - genome balance is reported between plants in the polyploid series.

1665 *Theis, T.* et al. *Oat varieties with adult plant field resistance to race 264 of crown rust.* (*p. 657*).

Of the large number of varieties tested for reaction to crown rust race 264, SES52 from Africa, DL41372 from Argentina and KHC from France (CI 7147, 7171 and 7181 respectively) exhibited a high degree of resistance. A number of lines representing wild *Avena* species were also found to be highly resistant.

1666 Lipaeva, L. I.
(The genetics of resistance of plants to infectious diseases and insect pests).
Bjull. mosk. Obšč. Ispyt. Prirod. (Bull. Moscow Soc. Nat.) : Otdel biol. (Biol. Ser.) 1960 : **65** : No. 2 : 121–34. [Russian].

A review is given of the literature, starting with that of Biffen, special consideration being given to the localization of resistance genes in particular parts of chromosomes and to the use of monosomics, induced mutations, interspecific and intergeneric crosses and mixed races possessing different resistance genes. It is pointed out that all the above approaches represent aspects of the problem of increasing the available genetic diversity as formulated by N. I. Vavilov.

1667 Beetle, A. A. (Editor)
Agricultural problems in arid and semiarid environments.
Bull. Wyo. agric. Exp. Sta. 1960 : No. 367 : Pp. 64.

This bulletin consists of the contributions to a symposium held in May 1959 at the 35th annual meeting of the Southwestern and Rocky Mountain Division of the American Association for the Advancement of Sciences and 30th annual meeting of the Colorado-Wyoming Academy of Science, at the University of Wyoming. It deals with arid and semiarid environments in the USA and includes a paper on Problems in genetics and breeding in the Southwest by D. W. Robertson.

CEREALS

1668 Gluščenko, I. E., Afanas'eva, A. S. & Novožilova, N. P.
(Internal changes in the cells caused by X rays in some cereals).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1959 : No. 9 : 3–9. [Russian].

Anomalies observed in root cells of young wheat and oat plants, following treatments with 8000 r. or 16,000 r. at the USSR Institute of Genetics included gemmation of nuclei, formation of micronuclei and chromatin granules and bridging. Varietal differences in sensitivity of wheats to X irradiation were noted.

1669 Vorträge der Weihenstephaner Hochschultagung vom 4.–6. Juni 1959 in Weihenstephan. (**Lectures at the Weihenstephan University Session of 4-6 June 1959 at Weihenstephan**).
Bayer. landw. Jb. 1959 : **36** : Sonderheft 2 : Pp. 116.

In the report from the Institute of Field-crop Cultivation it is mentioned that two gamma fields, one large and one small, are being constructed for mutation breeding.

Wheat. The German market is giving more attention to baking quality and tests have been made of the quality of 402,782 samples in the last 14 years [cf. 318]. They confirmed the higher gluten content of the spring varieties and the negative correlation between grain yield and gluten content. The American variety Rival proved the most drought resistant.

Barley. Tests in connexion with the European Brewery Convention have shown the German barley varieties to be the highest in grain yield, number of grains per ear, straw length, percentage of good grains and extract and lowest in husk percentage. Varieties have been found to differ in their behaviour during malting; certain varieties that behave similarly and probably require similar conditions for optimum malting are indicated.

A key for the identification of German barley varieties on grain characteristics has been worked out.

The varieties with the greatest drought resistance were Dometzkoer, Moravia, Morgenrot [Dawn Red] and Wisa.

Observations on a number of lines of barleys that had been preserved in sealed glass tubes for 125 years showed the old varieties to be weaker in the straw and 30–50% lower in yielding capacity than modern varieties.

1670 Solotarev, E.
Ergebnisse der Getreideversuche des Jahres 1958/59. (**Results of the cereal trials of the year 1958/59**).
VersErgebn. BundesVerAnst. alpenländ. Landw., Gumpenstein 1960 : No. 52 : Pp. 72. (Mimeographed).

The results of trials of wheat, rye, oats and barley carried out at stations in Austria are reported in detail.

1671 Tramel, J. L., Starling, T. M. & Roane, C. W.
Results of small grain varietal tests conducted in Virginia in 1959.
Res. Rep. Va. agric. Exp. Sta. 1959 : No. 32 : Pp. 32. (Mimeographed).

Information is given on the yields, disease reactions and other aspects of the performance of released and experimental varieties of wheat, oats and barley tested during 1957–59.

1672 Lunden, A. O.
Some effects of ultraviolet light on barley and oat embryos.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1905 : p. 4493. (Abst.).

Investigations were carried out on the cytological and genetical effects of exposing the terminal apices of the embryos to various doses of ultraviolet rays (2537 Å.) [cf. 1494]. The majority of induced chlorophyll-deficient types appeared to be recessive. The most effective mutagenic treatments consisted of doses in excess of 20,000 ergs per mm.^{2}, using apices from which only the first leaf had been removed. Treatment of dry caryopses was not as effective as exposure of those soaked for ½–24 hr. With soaking for 48–96 hr. at low temperature, very few mutations were obtained.

1673 Kravčenko, M. L.
(**Cytoanatomic characteristics of coalescence of embryo tissues of cereals transplanted to dry grains**).
Z. obšč. Biol. (J. gen. Biol.), Moskva 1960 : **21** : 361–67. [Russian].

An account is given of experiments on embryo transplantations at Čerkassk and the cytological and anatomical characteristics of coalescent tissues in grafted grains of maize/wheat, rye/wheat, maize/maize, rye/rye and barley/barley. An embryo graft between the maize varieties Har'kov 23 and Gruševka was characterized by mixed inheritance. An ear with a red rachis resembling that of Har'kov 23 was produced in the F_0, but a small portion of the rachis was white as in Gruševka. The grains on the red portion of the rachis were white, while the others were pink. The F_1 raised from the pink grain bore ears having grain intermediate in shape, colour and consistency between the graft components.

1674 Sortenratgeber. Getreide. (**Variety adviser. Cereals**).
DLG-Verlag, Frankfurt am Main 1960 : Pp. 64.

Tabulated data and notes are provided on wheats, oats, ryes and barleys tested in Federal Germany.

1675 **Seed bulletin. Spring sown cereals.**
IVRO, Wageningen 1960 : Pp. 24.

Brief descriptions and data on agronomic characters, yield and quality are given for 5 wheats, 13 barleys, 1 rye and 22 oat varieties. The barley Delta [cf. XXX, 2669] and the oat varieties Diamant [Diamond] and Marino have recently been added to the Netherlands Varietal List. Diamant (Pendek x Royal CA) has large plump white grain, yields well on heavy soils, has short, very stiff straw, is leafy and ripens late. Marino is early, with short, stiff, fairly resilient straw, gives high yields, especially on fertile soils, and has large plump grain; it was developed from Marne x Abed Minor.

1676 **Seed bulletin. Winter sown cereals.**
IVRO, Wageningen 1960 : Pp. 20.
Descriptive notes and data on yield, quality and agronomic characters are given for 15 wheats, 7 barleys and 6 ryes grown in the Netherlands. The following Netherlands varieties have been recently admitted to the Netherlands Varietal List: the wheat Falco, from Minister x Lovink, which yields well, has short straw, is well adapted to combine harvesting and little attacked by yellow rust; the barley Jumbo (Vindicat x Breustedt 75/29), which yields well on all soil types and shows quick development and good soil coverage; and the high-yielding rye Zelder, developed from crosses of five varieties, which produces large plump grain and grows rapidly in spring.

1677 MELETTI, P.
Revisione critica delle tecniche di innesto fra graminacee con particolare riguardo ai metodi di trapianto embrionale. **(Critical revision of the techniques of grafting Gramineae with special reference to the methods of embryo transplantation).**
Nuovo G. bot. ital 1959 : **66** : 438–50.
A full description is given of the technique chiefly recommended, which involves pre-soaking ripe grains in water for 24 hr. at 16–18° C., removal of the embryo without attached endosperm by light pressure, and transfer of the embryo to a grain from which the embryo has been removed, no adhesive being used. Other techniques considered more briefly are: (1) grafting additional endosperms; (2) softening and extracting the endosperm and replacement by another endosperm; (3) plumule grafting; and (4) grafting of longitudinally split grains.

1678 ANDERSON, J. A.
1959 Report of the Grain Research Laboratory, Board of Grain Commissioners for Canada, Winnipeg, Manitoba.
Ottawa 1960 : Pp. 84.
Various technological investigations on hard red spring wheat, durum wheat and barley are reported. A survey of quality in world wheats has been undertaken. The results of quality tests on new and standard varieties of these crops are summarized.

1679 KÄMPF, R.
Eine Möglichkeit zur Mechanisierung der Getreideernte bei exakten Sortenversuchen. **(A possibility of mechanizing the cereal harvest in precise varietal trials).**
Z. Acker- u. PflBau. 1960 : **111** : 179–90.
Alterations to a Massey Ferguson 630S combine harvester are described. The modified machine has a smooth and rapid action and is particularly good with lodged crops; only one operator is required in addition to the driver. It may not be used for tests in which the grain is required for further trials because it is impossible to empty the machine completely and some mixing of grain occurs. The technique of using this harvester in varietal trials is discussed in detail.

1680 Die Widerstandsfähigkeit wichtiger Getreidesorten gegen Pilzkrankheiten. **(The resistance of important cereal varieties to fungous diseases).**
Landwirtschaft 1960 : No. 13 : 4–5.
[Cf. 259].

1681 CHARLESS RATNASWAMI, M.
Studies in cereals-structure in relation to drought resistance.
Madras agric. J. 1960 : **47** : 427–36.
The structural characteristics of eight millet species and maize were studied in relation to drought resistance. Tabulated information is provided on the root development, stele volume, number of vascular bundles in the stem and leaf sheath, cutinization of the lower epidermis of the leaf blade and other characteristics of *Sorghum durra*, the most drought-resistant millet, and of the other species studied.

1682 GUYOT, L. & MASSENOT, M.
Observations et expérimentations sur la rouille noire des céréales et des graminées au cours des années 1957 et 1958. **(Observations and experiments on black rust of cereals and grasses during the years 1957 and 1958).**
Ann. Inst. nat. Rech. agron., Paris : Sér. C 1960 : **11** : 153–81.
The incidence of different physiological races of *Puccinia graminis* on wheat, oats, barley, rye and various grasses in France and parts of Germany, Spain and north Africa is recorded. The reaction of a wide range of European and introduced wheat varieties to the different physiological races was determined at the

Botanical Laboratory of the National Agricultural College at Grignon. Four wheat varieties, recognized for their resistance to stem rust, Oro, Regent, Guatraché and GN (= 80–3), were found to be susceptible to race 27. Immunity to race 21, the most prevalent race on wheat, was noted in Newthatch, Thatcher and Timstein.

1683 Leijerstam, B.
Physiological races of cereal rusts in Sweden in 1959.
Robigo, Castelar 1960 : No. 10 : 26–27; also in Spanish, 27–29. (Mimeographed).
Leijerstam, B.
Fysiologiska raser av stråsädesrost i Sverige 1959. (**Physiological races of cereal rusts in Sweden in 1959**).
Växtskyddsnotiser 1960 : **24** : 35–37.

The most common races of wheat stem rust in 1959 were 21 and 191; the latter has never previously been identified in Sweden. Among wheat leaf rusts, races 20, 57 and 107 were most frequent. Eight races of oat stem rust were identified, the predominant ones being 3, 6, 6A, 7 and 7A. The most common races of oat crown rust were 228, 231 and 239. Races 272 and 283 were identified for the first time in Sweden [cf. XXX, 1379].

WHEAT

1684 Daniel, G. H.
Winter wheat variety trials, 1955-58.
J. nat. Inst. agric. Bot. 1959 : **8** : 577–84.

A report is given on 46 trials conducted at centres in England to test Flamingo, Marsters 57, Starke, Merlin and Marne-Desprez, with Hybrid 46 and Cappelle-Desprez as controls.

1685 Evans, A. W.
Spring wheat variety trials, 1955-58.
J. nat. Inst. agric. Bot. 1959 : **8** : 585–92.

This report deals with the performance of Jufy I and Phoebus, tested in 21 primary and 16 small-scale preliminary trials, mostly in England, in comparison with Atle, Koga II and Svenno.

1686 Nagy, Z. & Tóth, J.
A kísérleti gazdaságok búzatermesztési tapasztalatai. (**The wheat yield trials of the experimental farms**).
Agrártudomány 1960 : **12** : No. 6 : 44–53.

Data on the yields of ten varieties tested at various stations in Hungary are given.

1687 Gosi, L.
Storia del miglioramento del grano. (**The history of wheat improvement**).
Agricoltura, Roma 1960 : **9** : 38–42.

The wheat breeding work of Strampelli and Maliani is described and some of their principal varieties are illustrated.

1688 Trentin, A.
Sperimentazione collegiale sul grano per la campagna 1959–60. (**Collective tests with wheat for the season 1959-60**).
Agricoltura d. Venezie 1960 : **14** : 462–64.

The tests included a certain number of cultivars only recently released but the best results were still given by Produttore [Yielder], Funotto, Leonardo, Leone [Lion], S. Pastore, Funone, Funo, Generoso, S13 and Mara. The most promising among the new cultivars were Fortunello, Gallini, Libellula and Lepre [Hare].

1689 Andrianova, K. S.
(**The population method as the means of obtaining productive progenies of winter wheat**).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 35–37. [Russian].

Hybrid populations with high grain yields have been bred from Lutescens 230 x Lutescens 329, Stepnaja 135 [Steppe 135] x Lutescens 230 and Lutescens 230 x Saratov 3 at Saratov. The hybrid progenies were subjected to single plant selection, the progeny of each selection being raised separately to form a population.

1690 Drăghici, L.
Soiuri de grîu de toamnă cultivate în condiţii de irigaţie în zona de silvostepă a bazinului mijlociu al Argeşului. (**Winter-wheat varieties cultivated under irrigated conditions in the woody-steppe zone of the middle stretch of the basin of the Argeş**).
An. Inst. Cerc. agron., București : Ser. C 1958 : **26** : 119–28.

Six varieties were tested but differences between them were only slight.

1691 Dalas, V.
Noi linii de grîu de toamnă create la staţiunea Tîrgu-Frumos. (**New lines of winter wheat produced at the Tîrgu Frumos station**).
An. Inst. Cerc. agron., București : Ser. C 1958 : **26** : 129–34.

Out of several hybrid selections raised at the above station, two are especially promising: line 1937GS, selected from a wheat-rye hybrid, and line 60 (A15 x Hard Federation). These lines exceed the standard A15 in yield and rust resistance.

1692 Dalas, V.
Rezultatele experimentale cu linii noi şi soiuri de grîu de primăvară la staţiunea de cercetări agronomice Iaşi, în anii 1956–1958. **(Experimental results with new lines and varieties of spring wheat at the Iaşi Agricultural Experimental Station in the years 1956–58).**
Stud. Cercet. şti : Biol. Şti. agric. Iaşi 1960 : **11** : 117–23.

Trials of 3 varieties and 11 breeding lines are reported, data being provided on yield, earliness, resistance to lodging and diseases and quality. The highest yield was given by line Iaşi 2690/52 [(Garnet x Marquis) x Cicin 22,850], which was also two days earlier than the control Lutescens 62. Second in yield was Iaşi 3707/52 (Manitoba x Garnet).

Seventeenth annual report on winter wheat improvement in Ontario, 1959 crop.
1960 : Pp. 17. (Mimeographed).

1693 *Waddell, W. H. Winter wheat improvement at Ontario Agricultural College. (pp. 1–4).*

Varietal trials conducted at six centres are reported. The new hybrid GC623 showed considerable promise; it was higher than all other varieties in yield and straw strength, had good bushel weight and showed considerable resistance to leaf rust as compared with Genesee. Kent, which was introduced in 1957, also performed better than Genesee, largely because of its superior winter hardiness and its excellent disease resistance.

1694 *Gfeller, F. & Whiteside, A. G. O. Winter wheat improvement at the Central Experiment Farm, Ottawa. (pp. 5–6).*

A number of hybrids, including lines derived from Rex-Oro x Cornell 595^2, have shown good resistance to the dwarf and common bunt races present in Ontario. In general, these lines are, however, deficient in yielding ability.

1695 *The co-operative winter wheat test. (pp. 11–17).*

Information is given on the performance of 13 varieties at three centres in Ontario. The varieties Cor x Ott 3042, 361 R20 and 4313-51-10 gave promising results.

1696 Gutierrez, M. E.
Researches on wheat at the Araneta University.
Araneta J. Agric. 1960 : **7** : 32–35.

The performance of introduced varieties in the Philippines is discussed.

1697 Cabanos, J. B.
Annual Report on wheat trial plantings.
Araneta J. Agric. 1960 : **7** : 46–79.

The results of varietal trials conducted at several centres in the Philippines are reported.

1698 Nandpuri, K. S.
Inheritance of date of heading in three wheat crosses.
Indian J. Genet. 1959 : **19** : 186–93.

The results of this investigation, which was carried out at the Hyslop Agronomy Farm, Corvallis, Oregon, have already been briefly reported [XXIX, 3681].

1699 Crumpacker, D. W. & Allard, R. W.
A diallel cross analysis of heading date in wheat.
Genetics 1960 : **45** : 982–83. (Abst.).

Ten spring wheats which have at some time or other been grown commercially in California were chosen as parents. Statistically significant, but trivial, interactions of genotype with microenvironmental differences within years were detected, while nonallelic gene interaction (epistasis) was a minor, but statistically significant, feature. Neither of these disturbances appeared to be a source of serious bias. The analysis suggested that the average degree of dominance was partial and towards earliness. Cases of apparent partial dominance for lateness occurred in certain crosses. The dominance effects of different genes were unequal. There appeared to be an excess of recessive, as well as late, gene effects among the parents. According to degree of dominance, the parents could be placed in one of three groups: highly dominant, moderately recessive and highly recessive. The limits of selection within the system for genes with dominance effects are probably already represented by certain of the parental genotypes. The exact nature of the epistatic effects was not determined.

1700 Omar ['Umar], A. A. M.
Inheritance of awnedness and waxiness in vulgare wheat.
'Ain Shams Sci. Bull., Cairo 1958 : No. **3** : 143–51.

In crosses among Egyptian and introduced spring wheats, the awnletted condition (B_1) was dominant over the fully awned (b_1), and waxiness (Wx) on the leaf sheath and lamina was dominant over nonwaxiness (wx). $Wxwx$ and B_1b_1 were inherited independently.

1701 Sikka, S. M., Jha, K. K. & Swaminathan, M. S.

Monosomic analysis in bread wheat. II. Identification of chromosomes carrying genes for awning and glume beak.

Indian J. Genet. 1959 : **19** : 56–63.

The inheritance of awn expression and glume-beak shape was studied in crosses of three varieties of wheat, E952 (Rio Negro), E220 (Kenya C10854) and NP790, with 21 different monosomic lines of Chinese Spring. The results indicated that E592 has the recessive alleles of genes *Hd* and B_2, the two awn-inhibiting genes present on chromosomes VIII and X of Chinese Spring. E220 lacks the genes *Hd* and B_2 on chromosomes VIII and X respectively but has the dominant awn inhibitor B_1 on chromosome IX and a gene b_2^a, for half-awned condition, allelic to B_2 on chromosome X [cf. X, 937]. Acuminate glume beak is associated with full beardedness and occurs only with the recessive condition of the awn-inhibiting genes B_1 and B_2. B_2 individually reduces beak length and determines acute shape, while B_1 also reduces beak length and determines obtuse shape. B_1 is epistatic to B_2. Chinese Spring has an acute beak due to the presence of gene B_2 on chromosome X. E952 has an acuminate beak, being a full-bearded variety with the recessive alleles of the awn inhibitors. Both E220 and NP790 have an obtuse beak owing to the presence of B_1 on chromsome IX. [Cf. XXVII, 2796].

1702 Singh, M. P. & Swaminathan, M. S.

Monosomic analysis in bread wheat. III. Identification of chromosomes carrying genes for resistance to two races of yellow rust in Cometa Klein.

Indian J. Genet. 1959 : **19** : 171–75.

Deviating ratios in some F_2s of crosses of the 21 different monosomics of Chinese Spring with Cometa Klein indicated that the latter variety carried two recessive genes for resistance to race H of *Puccinia glumarum*, respectively situated on chromosomes IV and VI, and one recessive gene on IX for resistance to race 13. These findings, together with those of investigators who have identified chromosomes carrying genes for resistance to stem and leaf rusts, suggest that the genes for rust reaction occur more frequently in chromosomes of genomes A and B than in those of D [cf. 1701].

1703 Ray, M. & Swaminathan, M. S.

Monosomic analysis in bread wheat. IV. Morphology and pairing of chromosomes in some monosomics and nullisomics of Chinese Spring and Redman.

Indian J. Genet. 1959 : **19** : 176–85.

Observations of the morphology of chromosomes II–VII, IX, X, XI, XVI, XX and XXI are recorded. Discrepancies between the arm ratios determined by Sears and the authors for V and XI are noted. Metaphase I was studied in three nullisomics of Chinese Spring and one of Redman involving homeologous group 5 (V, IX and XVIII), to ascertain whether any multivalents were produced. Nulli-V of Redman had a trivalent in some cells, with a mean configuration of $0{\cdot}11 \pm 0{\cdot}043_{III} + 18{\cdot}59 \pm 0{\cdot}097_{II} + 2{\cdot}48 \pm 0{\cdot}199_{I}$. Chinese Spring nullisomics V, IX and XVIII formed no multivalents. Some degree of stickiness was observed in the four nullisomics. No evidence was thus obtained confirming the occurrence of a multivalent-suppressor gene on V, as reported by other investigators. A single interchange could have accounted for the trivalent in nulli-V of Redman.

1704 Sikka, S. M., Jain, K. B. L. & Parmar, K. S.

Evaluation of the potentialities of wheat crosses based on mean parental and early generation values.

Indian J. Genet. 1959 : **19** : 150–70.

The results of a study of the parents and F_1–F_3 of 12 intervarietal crosses at the Indian Agricultural Research Institute, New Delhi, suggested that use of data from replicated yield trials of bulk crosses in the F_2 as a basis of choosing crosses which should be carried forward would be justified. In general, F_3 performance with respect to grain yield and other characters was predictable with greater certainty from F_2 data than from parental or F_1 values. F_1 yields as a means of predicting performance in subsequent generations was of limited value. Parental values for ear number, grain number per ear, ear length, spikelet number per ear, plant height and heading date, but not for 100-grain weight and grain yield, showed significant positive correlations with F_3 data.

1705 Fadrhons, J.
Šlechtění ozimé pšenice s krátkým jarovizačním stadiem. (**Breeding winter wheat with a short vernalization stage**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1501–14.

Dobrovice 1689/54 and Dobrovice 1711/54 are selections from a cross between Chlumec 12 and Carsten's V. They exceed the parents in grain yield by 15% and equal them in yield of straw. Their grain yield equals that of the leading varieties Kaštické osinaté [Kaštice Awned] and Pavlovice 198 but the straw yield is 4–7% lower. The period required for vernalization is 22 and 26 days respectively, whereas Chlumec 12 requires 18 days and Carsten's V 60 days. The new strains also equal the better parent, Chlumec 12, in grain quality, are earlier than both parents and equal Carsten's V in resistance to *Puccinia triticina*. Their resistance to *Erysiphe graminis* f. sp. *tritici*, *Tilletia tritici* and *Ustilago tritici* is average and they are more resistant to lodging than the parents.

1706 Zizin, N. W. [Cicin, N. V.].
Darwin und einige Fragen der Biologie. (**Darwin and some problems of biology**).
SB dtsch. Akad. LandwWiss. Berl. 1959 : **8** : Pp. 19.

The importance of wide interspecific and intergeneric hybridization for creating new varieties of cultivated plants is discussed with reference to work carried out on cereals in Moscow [cf. XXIX, 2410–2426].

1707 Murty, G. S. & Sethi, K. L.
Inheritance of leaf chlorosis in an interspecific cross between *Triticum durum* and *T. dicoccum*.
Curr. Sci. 1960 : **29** : 360–61.

E.2025, a *T. durum* variety which is highly resistant to brown rust, was crossed with IC1057, a *T. dicoccum* line highly resistant to black rust. Although the F_1 was normal, the F_2 segregated on the basis of 13 normal : 3 chlorotic, which suggests the epistatic action of an inhibitor suppressing the phenotypical expression of chlorosis. Data from other crosses indicated that chlorosis, the gene for which is carried by E.2025, is dominant over normal.

1708 Tulpule, S. H.
Cytological basis for a case of sterility in an interspecific wheat hybrid.
Indian J. Genet. 1959 : **19** : 194–98.

In an F_1 population of nearly 150 plants from a cross between *Triticum dicoccoides* and *T. durum*, two individuals were highly sterile. On the basis of meiotic observations, the sterility is attributed to extensive chromosome fragmentation at early prophase arising through stickiness. Except for occasional irregularities, meiosis was normal in fertile plants in the same F_4. The F_1 of this cross was partially sterile and partially sterile individuals have been encountered in each successive generation. The basic cause of the fragmentation is thus probably genic.

1709 Cikov, D.
(**The effect of short days on hybrids between branched wheat and hard wheat**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **8** : 63–77. [Bulgarian].

In hybrids of branched wheat (*Triticum turgidum*) and *T. durum*, short days extended the period of ear formation and thus increased productivity of both ear and plant, particularly when temperature and soil conditions were favourable to vigorous growth. Low temperatures (2–5° C.) seem to decrease both the positive effect of short days and the negative effect of long days upon ear formation. Annual selection of the male parent, *T. durum*, under short-day conditions did not affect the productivity of the hybrids.

1710 Nishikawa, K.
(**Studies on abnormal development of seeds resulting from hybridization. I. Abnormal development of the endosperm and growth substance fluctuation in *Aegilops squarrosa* x *Triticum dicoccum***).
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. **10** : 84–94. [Japanese].

The combination 2*x Ae. squarrosa* x *T. dicoccum* is 0% crossable, while 4*x Ae. squarrosa* x *T. dicoccum* is 40·7% crossable. The sterility of the first combination is associated with initial hypertrophy and subsequent collapse of the endosperm and retardation of embryo development from 120 hr. after pollination. The abnormal development of the endosperm is associated with a very high production of growth substance in the embryo sac, 20·5 units five days after pollination compared with 2·4 units in *Ae. squarrosa* x *Ae. squarrosa*.

1711 Kolev, D.
(Some questions of hybridization between the common soft wheat and rye).
Nauč. Trud. visš. selskostopan. Inst. V. Kolarov (Sci. Trans. V. Kolarov high. agric. Inst.), Plovdiv 1957–1958 (1959) : **6** : 319–32. [Bulgarian].

The following types of wheat-rye hybrid were obtained: (1) typical hybrids which were sterile or of very low fertility in the F_1 and showing much variation in form with a gradual return to the characters of the female wheat parent in subsequent generations; (2) hybrids which closely resembled the female wheat parent and showed normal fertility in the F_1; and (3) plants with normal fertility which differed from the wheat mother plant in some respect. It is supposed that hybrids of the first type arose by complete assimilation of the gametes and that with the other types there was incomplete assimilation of maternal and paternal gametes.

1712 Nakajima, G.
Cytogenetical studies on the intergeneric F_1 hybrids between *Triticum macha* and four species of *Secale*.
Japan. J. Bot. 1960 : **17** : 139–51.

Using *T. macha* as female parent in crosses with *S. cereale, S. vavilovii, S. africanum* and *S. montanum*, 28, 38, 9, and 61 plants respectively were obtained. While exhibiting morphological characters from both parents, the progenies tended to resemble the female parent more closely. Fertility in the hybrids was low and a chromosome number of 28 was recorded in all plants examined. The range of bivalents observed was 0–3, 0–4, 0–5 and 0–6 in crosses with *S. africanum, S. cereale, S. vavilovii* and *S. montanum* respectively, with the mode at 1_{II} in each case. Trivalents were rarely observed in *S. cereale, S. vavilovii* and *S. montanum* hybrids and none were seen in *S. africanum* hybrids. No tetravalents were found. The bivalents observed may have resulted from autosyndesis between chromosomes of genomes A and B or AB and D of *T. macha*.

1713 Riley, R.
Genetic manipulation of wheat.
Discovery 1960 : **21** : 510–17.

This popular article describes some of the techniques being used at the Plant Breeding Institute, Cambridge, to transfer useful genes from rye to wheat [cf. XXX, 3681]. Reference is also made to similar work being carried on elsewhere.

1714 Mendiola, N. B.
Report on wheat work in the Araneta University for the academic year 1959–1960.
Araneta J. Agric. 1960 : **7** : 1–24.

Studies on wheat-rice hybridization are reported. In the successful crosses, the rice variety Fortuna was used as the female parent, the male parents being the wheat varieties DNS, Ruby, Insignia and Manitoba. Two seeds are said to have been obtained from each of the crosses except in the case of Fortuna x Insignia, when only one seed was obtained. All crosses in which wheat acted as the female parent were failures. The adaptability of a large number of introduced wheat varieties has been investigated.

1715 Tarnavschi, I. T. & Lungeanu, I. G.
Observaţii asupra comportării amfiploidului *Triticum vulgare* Vill. var. *erythrospermum* (Körn.) Msf. "A15" x hibrid grîu-pir–generaţiile 1–3. [**Observations on the behaviour of the F_1–F_3 of amphidiploid T. *vulgare* Vill. var. *erythrospermum* (Körn.) Msf. 'A15' x a wheat-*Agropyron* hybrid**].
Lucrăr. Grădin. bot. Bucureşti 1960 : 107–13.

The male parent was a 35-chromosome hybrid of uncertain parentage. A hybrid with $2n = 56$ chromosomes was obtained from the above cross, presumably from the fertilization of a reduced egg by an unreduced sperm. From this plant F_2 and F_3 generations were raised. Various meiotic irregularities observed in these are noted. The advanced generations were perennial and some lines inherited the disease resistance of the male parent. Fertility improved in advanced generations and the protein content of the hybrids was higher than in the wheat variety A15.

1716 Grünvald, C. & Gutenmacher, I.
Contribuţii la studiul biologiei unor soiuri polimorfe de grîu. (**Contributions to the study of the biology of some polymorphic wheat varieties**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 85–100.

Wide variation in morphological characters, vegetative period, lodging resistance and baking quality has been found within Rumanian material of the varieties Marquis, A15 (selection of Tenmarq) and Bánkút 1201. The variation appears to be partly due to hybridization. Variation in caryotype and irregularities at cell division are also reported.

1717 Remeslo, V. N.
(Developing high yielding varieties by directed changing of spring wheat into winter wheat).
Agrobiologija (Agrobiology) 1959 : No. 4 : 498–503. [Russian].

This report on training spring wheats for the winter habit includes additional details of Mironovka 264 [cf. XXVIII, 1496]. In recent Ukrainian trials it outyielded Belaja Cerkov' 198, Erythrospermum 15 and Ukrainka and was immune from *Oscinella, Phytophaga* and fairly resistant to *Puccinia.*

In addition to Mironovka 264, mention is made of other high yielding winter wheats which were obtained by directed training of such spring varieties as Ukrainka, Artemovka and Odessa 13. The new wheats are described as being winter hardy and resistant to fungi and having high quality grain, rich in protein and gluten. In preliminary trials conducted in 1958 they yielded 52–55 c. per ha. as compared with 46·3 c. from the standard variety Belaja Cerkov' 198.

1718 Lysenko, O. T.
(The problem of converting non-winter-hardy varieties into winter-hardy forms).
Agrobiologija (Agrobiology) 1959 : No. 4: 504–11. [Russian].

An account is given of experiments at Gorki Leninskie on the improvement of the winter hardiness of some winter-wheat cultivars from England. The methods consisted of (1) shattering the heritable basis of the wheats by sowing them as a spring crop for one generation and then for several generations as a winter crop under the harsher conditions of Moscow, and (2) training the winter wheats, first for the spring habit, and then reconverting them into winter wheats by sowing them repeatedly as winter wheats in the new environment. The first stage of treatment (2) has now been accomplished. The results of treatment (1) were upset by an unusually mild winter in 1958–9, when all the material, including the initial forms, overwintered well. Bersée proved to be a spring variety under Moscow conditions.

1719 Rajki, S.
Közönséges búzafajták tenyészideje és megváltoztatásának egyes módjai. **(The vegetative period of common wheat varieties and some ways of transforming them).**
Növénytermelés 1960 : 9 : 113–30.

The first part of this paper is concerned (*a*) with studies of vernalization requirements in about 100 wheats, figures being given for 30 of these and (*b*) with the cold requirements in the field of three varieties. The second part contains data showing the greater yield, earliness, grain/straw ratio and straw strength of Italian as compared with standard Hungarian varieties. The Italian varieties, however, lack winter hardiness. In the last part, the following experiments on changing spring wheats into winter wheats with a shorter vegetation period are described. Seeds obtained after sowing the spring varieties Lutescens 62, Kompolti szálkás [Kompolt Awned] and Melanopus 69, the alternative wheat Marquis and the semiwinter wheat Aniversario [Anniversary] at three different dates in the autumn of 1955 were sown in the autumn of 1956, and half the seed from each of the offspring was sown in autumn 1957 and half in spring 1958. With the exception of one variant of Aniversario, the spring-sown material gave rise in 1958 to plants behaving as spring wheats. In the next season, however, after the same procedure, spring-sown seeds of Lutescens 62 produced variants showing the late-heading characteristic of winter wheats. It is noted that these variants are derived from seeds sown at the earliest date in the first autumn; this is in accordance with Lysenko's observations [cf. XXIX, 3661].

1720 Lindermanis, Ja. M.
(Winter-wheat varieties obtained from spring wheats).
Selekcija i Semenovodstvo (Breeding & Seed-growing 1959 : No. 5 : 48–49. [Russian].

Information is provided on economic characters of six winter wheats obtained by training local Latvian spring varieties for the winter habit at Priekuļi. They all outyielded the standard winter variety Kursas, and have higher 1000-grain weights and shorter straw, but have fewer grains per ear. While they were found to be sufficiently winter hardy they are susceptible to injury following the return of frost after a period of warm weather. Breeding work on the improvement of the new varieties in the latter respect is in progress.

1621 Nečiporčuk, I. D.
(The sowing of spring-wheat hybrids in the autumn).
Agrobiologija (Agrobiology) 1959 : No. 4 : 619–20. [Russian].

The winter wheats Erythrospermum 62, 65 and Ferrugineum 41, 63 and 64, all with highly productive ears, were obtained by training spring-wheat hybrids for the winter habit at L'vov in the Ukraine.

The initial material was provided by the grain from open pollination of Ostka Hlopickaja [Chłopicka Awned] by Dubljanka 4, Lutescens 62, Milturum 162 and some other varieties or from the cross Ostka Hlopickaja x *Triticum turgidum*. Tabulated data on 1000-grain weights, ear length, the number of spikelets and the amount of grain per ear and the average grain yield per ear for the five new winter varieties are provided.

1722 Rîjei [Ryžej], I. P.
Bazele biologice ale tehnicii noi de producere a semințelor de grîu. (**The biological basis for a new technique of wheat seed production**).
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. 5 : 88–100.
[Cf. XXX, 2500].

1723 Carson, G. P.
Descriptions of wheat varieties.
J. nat. Inst. agric. Bot. 1959 : **8** : 597–601.

Detailed descriptions are given of two varieties, recently recommended by the National Institute of Agricultural Botany, United Kingdom: the winter wheat Flamingo developed from (Tassilo x Kron) x Heines IV by the firm of Heine, Germany, and first distributed in 1957; and the spring wheat Jufy 1, selected from Jubilee x Fylgia at the State Agricultural Plant Breeding Station, Gembloux, Belgium, and first distributed in 1954 [cf. XXIX, 3667].

1724 Carolis, V. de
Il Damiano Cremona. (**Cremona Damiano**).
G. Agric. 1960 : **70** : p. 357.

In the course of work on the mass selection of Strampelli's Damiano, which has deteriorated in recent years owing to lack of rigorous seed selection, the Consorzio agrario di Cremona [Agricultural Association of Cremona] discovered a bright green deviant which has been multiplied and released under the designation Damiano Cremona.

1725 Barradas, M. T. & Malato-Beliz, J.
Como nasceram dois novos trigos. (**The birth of two new wheats**).
Agricultura, Lisboa 1960 : No. 5 : 12–16.

The two wheats described are both selections from a cross made in 1938 between Mentana 11582 and Ä24/585 from Svalöv. After yield tests of various selections from 1945 to 1959, the two best, which exceeded Mentana in yield by 14 and 26% respectively, were given the names Lusitano and Restaurção. In large-scale tests the excess of yield over that of Roma was 29 and 43% for the two wheats respectively. Restaurcão has red grain and Lusitano white. The former is suitable for soils of high fertility, the latter is 4–5 days earlier and has a wider range of adaptation. In baking quality both cultivars are better than wheats such as Roma, Mara and S. Pastore.

1726 Fajersson, F.
Weibulls original Ring vårvete. (**The Weibull original spring-wheat Ring**).
Weibulls Årsb. Växtföräd. Växtodling 1960 : 2–7.

Developed from a combination of Kärn [Kernel] with Pondus, Ring outyields Svenno, Drott [King] and Kärn II, particularly in eastern Sweden. It is a day later in maturity than Svenno, is superior in straw strength and resistance to sprouting in the ear and equals Svenno and the other varieties in mildew resistance and quality.

1727 Bhatnagar, M. P., Bhargava, P. D. & Gandhi, S. M.
4 new wheats to vie with Rajasthan locals.
Indian Fmg. 1960 : **10** : No. 5 : 38–39.

The following common wheats show promise for Rajasthan: NP718, the Punjab variety C591 and RS31–1 and RS9–11, both developed in Rajasthan from C591 x Red Jaipur Local.

1728 García S., A. *et al.*
Recomendaciones para la siembra de trigo en el noroeste. Ciclo 1960–61. (**Recommendations for the sowing of wheat in the northwest. Season 1960–61**).
Bol. Sec. Agric. Ganad., Méx. 1960 : No. 327 : Pp. 22.

Varieties suitable for cultivation in northwest Mexico are briefly described. Among them are two new early, high-yielding, varieties, Nainari 60 and Andes. Both are resistant to stem rust while Andes is, in addition, resistant to leaf rust.

1729 **Kaw, new winter wheat for two-state area.**
Crops & Soils 1960 : **13** : No. 1 : p. 20.

Released jointly by the Kansas and Oklahoma Agricultural Experiment Stations, the hard red winter wheat Kaw has early maturity, high test weight, good milling and baking properties, resistance to bunt, mature-plant resistance to leaf rust and only moderate susceptibility to stem rust. Like all hard red winter wheats, however, Kaw is highly susceptible to soil-borne mosaic.

1730 PFEIFER, R. P.
Redcoat winter wheat for Pennsylvania.
Progr. Rep. Pa. agric. Exp. Sta. 1960 : No. 227 : Pp. 2.

The soft red winter wheat Redcoat possesses the best combination of yielding capacity, straw strength, resistance to major diseases and resistance to Hessian fly so far bred into a variety adapted to conditions in Pennsylvania.

1731 BRIGGLE, L. W., SCHMIDT, J. W., HEYNE, E. G. & YOUNG, H. C. (JUN.)
Rules for abbreviating wheat variety names.
Agron. J. 1960 : **52** : p. 613.

The rules adopted by the National Wheat Improvement Committee of the USA for abbreviating names of varieties are given.

1732 HEYNE, E. G.
Registration of improved wheat varieties, XXIV.
Agron. J. 1960 : **52** : 655–58.

The following varieties have recently been registered cooperatively by the American Society of Agronomy and US Department of Agriculture: Conley [RI2563 (Thatcher x McMurachy-Exchange x Redman 2) x Lee], a hard red spring wheat with good resistance to stem rust [cf. XXVII, 3850]; Avon [cf. XXX, 283]; Cornell 595 [cf. XVII, 163]; Genesee (Yorkwin x Honor^2-Forward) [XXII, 289]; Henry [XVI, 621]; Lucas [Thorne x OSU101–3 (Portage x Fulcaster)], a soft red winter wheat distributed in Ohio in 1959, its chief advantages being good yield, high bushel weight and strong straw; Nured (Forward x Dietz), a soft red winter wheat distributed in 1939, useful for fodder on account of its high protein content; the soft white winter wheat Yorkwin (Dietz x Goldcoin), distributed in 1935; Coastal [Frondoso x (Redhart 3 x Noll 28)], distributed in 1949 by Coker's Pedigreed Seed Company; Coker 47–27 (Fronteira x Hardired), a soft red wheat with intermediate growth habit, distributed by this firm in 1950; Selkirk (RL2265 x Redman^3) [XXIV, 1786]; Colorow (Marquillo-Oro x Oro-Turkey-Florence), a hard red winter wheat released by the Colorado Agricultural Experiment Station in 1960, its chief merits being resistance to common and dwarf bunt, high yield and good milling and baking properties; and Saline [XXII, 2630].

1733 CIALZETA, C.
"Magnif Guaraní M.A.G." Nueva variedad comercial de trigo. **(Magnif Guaraní MAG. A new commercial wheat variety).**
Idia 1960 : No. 151 : 33–36.

This new variety, derived from (38MA x Lin Calel 46–11) x Klein Cometa, was bred at the Pergamino Experiment Station in Argentina. The variety, which is best sown between mid-June and mid-July, yields grain of high industrial quality. Tabulated information is presented on the susceptibility of the variety to *Puccinia graminis* and *P. triticina*, and on yield and quality characteristics, as compared with standard varieties.

1734 FAVERO, A.
Nuova razza di grano. **(A new wheat variety).**
Sementi elette 1960 : **6** : No. **4** : p. 45.

The variety MM, derived from a back cross of Mara x Stirpe 2392 [Line 2392], is an awnless winter wheat that ears late but ripens early; it is described as hardy and resistant to lodging, rust and *Septoria* (*Leptosphaeria*). It withstands high rates of manurial dressings and produces grain of good quality.

1735 POPE, W. K., FITZGERALD, P. J. & MCKAY, H. C.
Tendoy, a new hard red winter wheat for dry land areas in southern Idaho.
Bull. Idaho agric. Esp. Sta. 1960 : No. 333 : unpaginated.

Developed from Rex-Rio (CI12246) x Cheyenne back crossed three times to Cheyenne, Tendoy is similar in plant type and grain quality to Cheyenne but improved in bunt resistance, since it carries *M* and *R* for this character from Rex-Rio, as well as M_2 from Cheyenne.

1736 WATSON, I. A.
Gamenya and Mengavi: Two new wheat varieties for northern N.S.W.
Agric. Gaz. NSW 1960 : **71** : 393–403.

A detailed account is given of the development of the rust-resistant varieties Gamenya and Mengavi from Gabo x [(Gabo^5 x Mentana) x (Gabo^2 x Kenya 117A)] and (Gabo^6 x Mentana) x [Gabo^2 x (Eureka x CI12632)], respectively. These varieties are the result of breeding initiated in 1946 to produce wheats resembling

Gabo in agronomic and baking properties, but without its defect of leaf-rust susceptibility. Kenya 117A and CI12632 (a derivative of *Triticum timopheevi*) constituted the sources of resistance to leaf rust. Both Gamenya and Mengavi are resistant to the prevalent races of leaf and stem rust in northern New South Wales. Under conditions prevailing in 1959, when rust was not severe, the two varieties were at least equal in yield to Gabo in commercial trials. With severe rust damage, they may be expected to outyield Gabo. According to preliminary data, neither Mengavi nor Gamenya has the dough strength of Gabo. Whether lack of strength may prove to be a defect in samples with a lower percentage of protein remains to be ascertained from further analyses.

1737 PAL, B. P., MURTY, G. S., AMIR SINGH & DALJIB SINGH
Performance of some recently evolved New Pusa wheats.
Indian J. Genet. 1959 : **19** : 36–55.

The varieties NP 797, 798 and 799, all of which are selections from the cross Kenya E220 x NP165, have been included in yield trials in several major wheat-growing regions in India. All three varieties showed good resistance to black and brown rusts and in addition were highly resistant to loose smut. Tabulated information is given on the yield and maturity of the varieties in different Indian states; in all states ear emergence was earlier than in other varieties tested. Yield performance was particularly good in Bihar and West Bengal. These states are frequently subjected to severe attacks of rust and it would appear that the new varieties would be a valuable introduction.

1738 MORRISON, J. W.
Marquis wheat—a triumph of scientific endeavor.
Agric. Hist. 1960 : **34** : 182–88.

In this account, particular emphasis is laid on the methods adopted by Saunders in the breeding of Marquis.

1739 VASCONCELLOS, J. DE C. E
Origem, expansão e aptidões das espécies de trigo cultivadas em Portugal. **(The origin, expansion and adaptation of the species of wheat cultivated in Portugal).**
Rev. agron., Lisboa 1960 : **43** : No. 2 : 1–8.

A brief survey is given of the evolutionary history of *Triticum* with specia reference to the principal species and varieties grown in Portugal.

1740 DEKOV, D.
(The hard wheat from the Black Sea littoral of the Tolbuhin district).
Nauč. Trud. visš. selskostopan. Inst. G. Dimitrov. (Sci. Trans. G. Dimitrov high. agric. Inst.) 1959 : **7** : 407–24. [Bulgarian].

It was found that hard wheat has been grown in this district from time immemorial and common wheat was not introduced until the beginning of the XXth century. The hard wheat is more valuable here than in southern Bulgaria; it was introduced from many places, including southern Bulgaria, Macedonia, Turkey, Bessarabia, Banat and Russia. Of the 17 botanical varieties found in southern Bulgaria, 14 were found in Dobrudža. The varieties *erythromelan* and *leucomelan* were found in the Tolbuhin area but they were rather rare; these varieties have not been described before in Bulgaria.

1741 MATSUMURA, S.
Radiation genetics in wheat, IV. Relationship between genetic effects and X-rays of different wave lengths or γ-rays in a diploid wheat.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 11–21.

The effects of X rays of different wave lengths, using filters, on dormant grains of *Triticum monococcum* were investigated. In general, the frequencies of chromosome aberrations and gene mutations increased with decrease in wave length. This is attributed to the more scattered ionization caused by hard rays which promotes interchange rather than restitution. The above results are compared with those resulting from γ rays or neutrons and with those reported in earlier papers [cf. XXVIII, 1492 and 4052]; some discrepancies appear to be due to difficulties in measuring dose accurately.

1742 CHOPRA, V. L.
Pre-meiotic somatic-reduction in wheat.
Curr. Sci. 1960 : **29** : 362–64.

During a study of monosomic lines of the variety Chinese Spring, one anther of a plant monosomic for chromosome XX [cf. XXX, 1098] was observed to have cells with chromosome numbers ranging from 16 to 21. Details are given of the pairing behaviour of these cells.

Fourteen cells showed both closed and open bivalents, while in one cell only one open bivalent was present. The number of closed bivalents ranged from 1 to 3 per cell, with a majority of cells having 3. It is suggested that somatic reduction had occurred in a number of premeiotic cells. The fact that closed bivalents occurred regularly in all the cells studied suggests that undivided pairs of chromosomes were present in the nullihaploid cells. Thus chromosome distribution in the cells which underwent somatic reduction would have taken place at random without pairing and segregation of homologous chromosomes.

1743 Koedžikov, H.
(Soil humidity and the root system of some widely cultivated varieties of hard and common wheat).
Naučn. Trud. selskostopan. Akad. Georgi Dimitrov. Agron. Fak. (Sci. Trans. G. Dimitrov Agric. Acad. Agron. Fac.) 1958 : **5** : 49–79. [Bulgarian].

The two varieties of *Triticum durum* studied produced the greatest number and the longest primary roots at 40% moisture content, and the primary roots showed the greatest morphological activity at 60% and below. Two types of behaviour were seen among the three *T. vulgare* varieties studied. In 11 and 159, primary roots increased in number with increasing moisture and showed their most vigorous development at 60% moisture and below, while in 14, number of primary roots remained constant at different moisture levels and vigour was greatest at 60% and above. Other effects of moisture were similar in the different wheats.

1744 Karam Singh Nandpuri
Relationship between date of heading, plant height and tillering in three wheat crosses.
Indian J. Genet. 1959 : **19** : 107–09.

In a study at Corvallis, Ore., the varieties Alba, White winter and White Holland were crossed with Norin 10 [Ministry of Agriculture and Forestry 10]; correlation coefficients between date of heading, plant height and number of tillers were calculated in the F_2 and F_3 generations. Although the coefficients in some cases were statistically significant, they tended to be low in magnitude and inconsistent in different years. It was concluded that there was no important relationship between these characters that might influence a breeding programme.

1745 Petr, J.
Biologie českých přesívek I. Studium fyziologické podstaty přesívkovosti. **(The biology of Czech alternative wheats. I. A study of the physiological nature of alternativeness).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1473–1500.

The alternative wheats appeared to have no low temperature requirement for they showed little or no reaction to vernalization treatment. They were very sensitive to short photoperiod, which retarded development and affected morphological characters. The light stage lasted for 42–47 days in these wheats. Stupický Bastard [Stupice Hybrid], a half-winter wheat, showed a similar reaction to day length.

1746 Haimovici, B.
Metoda de hibridare ca factor de influenţare a valorii descendenţei hibride. **(The method of hybridization as a factor influencing the value of the hybrid progeny).**
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 101–17.

Using the variety Arnăut de Nemerci (= Arnautka Nemerčanskaja) as female parent, the following methods of hybridization were applied: open pollination, restricted open pollination (5–7 paternal ears) and enforced pollination by Arnăut de Nemerci; the same methods using one of four other varieties; and the same methods using a pollen mixture of the four pollinating varieties just referred to together with maternal pollen. In all combinations, the method of open pollination gave the highest yielding progeny.

1747 Kiričenko, F. G.
(Intervarietal open hybridization of winter wheat as a method of seed production).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 8 : 20–26. [Russian].

The hybrid from open pollination of Odessa 3 x Odessa 16, now in the F_7, exceeded its parental forms in grain yield at Odessa. The baking quality of the hybrid was good and in resistance to frost it was superior to the less winter hardy Odessa 3. It was resistant to drought and diseases.

1748 Katayama, Y.
Studies on the haploidy in relation to plant breeding. III. Some experiments on the artificial induction of parthenogenetic development.
Mem. Fac. Agric. Univ. Miyazaki 1960 : **2** : 89–99.

Parthenogenetic development occurred frequently in *Triticum monococcum* flowers which had been emasculated but was much less common in flowers of *T. durum* and *T. vulgare* similarly treated. Various hormones were injected into the ovaries of *Petunia violacea* and *Abelmoschus manihot*. All the hormones successfully induced parthenogenesis, the most effective treatment being 2,4-dichlorophenoxyacetic acid at a concentration of 0·01–0·1%. The influence of a number of tissue extracts was tested on *A. manihot*; extracts obtained from fresh leaves of *Houttuynia cordata* and from floral organs of *Hibiscus mutabilis* were particularly effective in stimulating ovary development.

Embryological studies of treated ovaries of *A. manihot* indicated that ovule development, under parthenogenetic conditions, depends on the development of both the nucellus and the inner integument.

Seedlings derived from intergeneric crosses between *P. violacea*, as female parent, and four other solanaceous species developed very irregularly and gave rise to plants which resembled *Petunia* in external appearance. A few of these plants ultimately bloomed; all were found to be diploids [cf. XXV, 2022].

1749 Greer, E. N.
Grading recommended wheat varieties as sources of biscuit flour.
J. nat. Inst. agric. Bot. 1959 : **8** : 593–96.

Wheats recommended by the National Institute of Agricultural Botany, United Kingdom, have been graded with respect to suitability for biscuit manufacture on the basis of extensometer dough tests and grain texture.

1750 Cernescu, L.
Acumularea substanţelor chimice în plantă în cursul perioadei de vegeţatie la cîteva soiuri de grîu de toamnă. (**The accumulation of chemical substances in the plant during the growing period in some varieties of winter wheat**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 31–42.

Data are provided on the protein and carbohydrate contents of three varieties, A15, Arnăut Studina and 62, throughout the life cycle. All varieties are closely similar in chemical composition until the stage of milk ripeness, at which time the differences that characterize the chemical composition of the grain of these three varieties become evident.

1751 Hristov, J.
(**Studies of the physical, chemotechnological, milling and baking properties of new varieties of soft wheat**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.) Sofija 1959 : **7** : 47–79. [Bulgarian].

Sixteen new and four previously introduced varieties fell into two groups on the basis of milling and baking tests conducted over four years at nine stations in Bulgaria. In the first group, with generally good technological properties, variety 44 was best, followed by T–10 and 127. The second group comprised varieties much poorer in quality.

1752 Pisarev, V. E. & Samsonov, M. M.
(**The question of breeding strong-floured wheats under the conditions of the Nonchernozem Belt in the Soviet Union**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 3–10. [Bulgarian].

[Cf. XXX, 295].

1753 Rusmanis, P. P. & Kreslin', È. Ja.
(**The methods of evaluating the bread-baking properties of wheat**).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 65–67. [Russian].

Details are given of baking tests and biochemical and physical properties of the flour and dough of some Latvian wheats which were studied at Stende. The best loaves were baked from the spring wheat Moskovka [wheat from Moscow] and the winter wheat Kursas. Both these varieties were characterized by low protease activity, high amylase activity and great elasticity of the gluten in comparison with the other varieties. Neither variety was rich in protein or gluten. The elasticity of the gluten was negatively correlated with protease activity.

1754 Zeleny, L., Greenaway, W. T., Gurney, G. M., Fifield, C. C &. Lebsock, K.
Sedimentation value as an index of dough-mixing characteristics in early-generation wheat selections.
Cereal Chem. 1960 : **37** : 673–78.

The usefulness of a sedimentation test in the selection of promising lines has been investigated in 159 F_3 lines resulting from a cross between Conley and the Portuguese strain PI56219–12. Highly significant correlations were found between the values obtained in the test and three dough-mixing properties. It is thought that the test may provide a useful simple guide for making early-generation wheat selections on the basis of dough characteristics. A semimicro technique is described whereby it should be possible to apply the test to the grain from individual plants.

1755 KITTERMAN, S. J., SEEBORG, E. F. & BARMORE, M. A.
A note on the modification of the five-gram milling-quality test and the five-gram micromill.
Cereal Chem. 1960 : **37** : 762–64.

"Elimination of the bran-weighing procedure and equipping a 5-gram micromill with a detachable hopper resulted in a 200% increase in the number of samples that can be evaluated for milling quality in a day, and significantly reduced operator fatigue."
[Authors' summary].

1756 RAM DHAN SINGH
Some new varieties of *Triticum sphaerococcum* Perc.
Indian J. Genet. 1959 : **19** : 199–200.

In addition to the six botanical varieties named by Percival, six others have been recorded but have not hitherto been named. Two of the latter varieties now receive the designations *T. sphaerococcum* vars. *randhawai* and *rubroglabrum* and are briefly described.

1757 PAL, B. P., UPADHYAYA, Y. M., KHAN, H. R. & RAMANUJAM, S.
A study of survival in a mixture of fourteen varieties of wheat.
Indian J. Genet. 1960 : **20** : 102–12.

Intergenotypic competition between 14 varieties of wheat, belonging to 11 species, was studied by measuring the percentage survival in five successive generations of mixed growing. No consistent association was found between survival ability and morphological and agronomic characters. The main factor which determined degree of survival of any variety appeared to be its reproductive ability, i.e. the number of grains produced per head and the ability of plants arising from these grains to establish successfully and reproduce normally. Certain rust-susceptible varieties were rapidly eliminated; this appeared to be partly the result of rust epidemics which occurred during the third and fourth year of the trial. The agronomic significance of competitive ability is discussed.

1758 KIRIČENKO, F. G.
Pracovní metody a výsledky vyšlechtování tvrdé ozimé pšenice pro stepní pásmo SSSR. (**Working methods and results of breeding hard winter wheat for the steppe zone of the USSR**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1339–46.

This work has been reported elsewhere [cf. XXX, 1437].

1759 POTOCANAC [POTOČANAC], J.
I risultati di ricerche sulla invernalità e resistenza alle basse temperature di frumenti italiani. (**Results of research on the winter hardiness of Italian wheats and their resistance to low temperatures**).
Sementi elette 1960 : **6** : No. 4 : 14–22.

Observations were made on 35 cultivars grown in Yugoslavia in the open, in boxes protected from snow, during the period 1956–60, during which the minimum winter temperatures were from — 16° to — 22·5° C. No variety proved equal in cold resistance to the local winter wheat Rumunska Crvenka [Red Rumanian] used as control but the Italian wheats Elia, S. Pastore, Autonomia, Virgilio, Leonardo, S13, S15 and Funone all proved hardier than U1, the other local cultivar used as control. A number of others were classed as satisfactory in resistance. Some of the Italian varieties behaved as winter wheats when sown in April whereas others behaved as spring wheats or were intermediate. The two latter groups were less hardy than the true winter types.

1760 NELSON, C. E.
A mechanical method for measuring resistance of wheat.
Agron. J. 1960 : **52** : 611–12.

Natural lodging and culm breakage measured by means of a machine essentially similar to that described by Clarke and Wilson [cf. IV, 662] were significantly correlated at the 1% level in experiments during 1958 and 1959 in Washington State, although in the latter year, when natural lodging was severe, use could be made of data on mechanical breakage taken at heading only, on account of the broken and distorted culms later in the season.

1761 NYQUIST, W. E.
Heterogeneity in the Norka differential wheat variety to a new race of *Erysiphe graminis tritici*.
Plant Dis. Reptr. 1960 : **44** : 126–28.

Inoculation of Norka with a new race of powdery mildew, designated Norka race, revealed the occurrence of both resistant and susceptible plants within the variety. It is concluded that the variety consists of two homozygous strains, Norka–1 (resistant) and Norka–2 (susceptible). Two possibilities are suggested: (1) that the original stock may have been heterozygous for resistance gene Ml_t in which case Norka–1 and Norka–2 would have the genetic constitutions Ml_tMl_t and ml_tml_t respectively, or (2) that a second resistance gene, Ml_x, exists; resistant and susceptible lines would then have the constitutions $Ml_tMl_tMl_xMl_x$ and $Ml_tMl_tml_xml_x$ respectively.

1762 Mathur, R. S., Athega, S. C., Mathur, S. C. & Jain, J. S.
Varietal resistance of wheat to loose smut in Uttar Pradesh.
Curr. Sci. 1960 : **29** : 353–54.

In a 5-year study on varietal differences in resistance to *Ustilago tritici*, the highest degree of resistance was found in Bansi CP. A further 13 varieties were moderately resistant.

1763 Rod, J.
Geneticko-fyziologická studie rezistence pšenic proti sněti prašné. V. Vyhlídky šlechtění na rezistenci. **(A genetical and physiological study of the resistance of wheat to loose smut. V. Prospects of breeding for resistance).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1347–62.

The susceptible variety Niva was crossed with the resistant Peragis and four back crosses were made to Niva; each year selection was carried out for complete resistance and for the other characters of Niva. In this way progenies were obtained equalling Niva in productivity. In 1957 the resistance of these hybrids broke down and also Peragis was slightly attacked. This failure is attributed to lack of adaptation and the occurrence of different biotypes of the pathogen. It is thought that further breeding for resistance should be on a wider genetic basis.

1764 Storčevoj, A. L.
(Wheat varieties resistant to *Tilletia controversa* are needed).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 63–64. [Russian].

Odina 3, Skorospelka 3b [Early 3b], hybrid 1495 and Stavropol' 1553 showed a fair degree of resistance to *T. controversa* among the varieties tested at Stavropol'. Stavropol' 1553 was also resistant to *T. tritici* and *T. laevis*.

1765 Dixon, G. E.
A review of wheat breeding in Kenya.
Euphytica, Wageningen 1960 : **9** : 209–21.

After a survey of breeding in Kenya since 1900, current lines of work are described [cf. XXXI, 1428, XXX, 188 and XXVIII, 3932]. Comprising relatively few varieties up to about 1950, the basis of breeding for rust resistance is now being broadened by the addition of imported parents, and interspecific and intergeneric crosses.

1766 Heard, T. G.
Stem rust of wheat.
J. Agric. S. Aust. 1960 : **64** : 134–35, 140.

Progress in breeding rust-resistant wheat varieties in Australia is described. Reference is made to MUOD48, a variety due for release in New South Wales; this variety is resistant to stem rust, leaf rust, bunt and mildew.

1767 Thorpe, H. C.
Wheat in Kenya and sources of resistance to rust.
Robigo, Castelar 1960 : No. 10 : 29–31; also in Spanish, 31–33. (Mimeographed).

Introduced varieties resistant to stem rust and to stripe rust are listed. Kenya varieties appear to possess some resistance to leaf rust.

1768 Hassebrauk, K.
Untersuchungen über die physiologische Spezialisierung des Weizenbraunrostes (*Puccinia recondita* Rob. = *P. triticina* Erikss.) in Deutschland und einigen anderen europäischen Staaten im Jahre 1958. [**Investigations on the physiological specialization of the brown wheat rust (*P. recondita* Rob. = *P. triticina* Erikss.) in Germany and some other European states in the year 1958**].
NachrBl. dtsch. PflSchDienst, Stuttgart 1960 : **12** : 106–07.

Amongst 258 samples of brown rust mainly from Germany, the races 1, 2 (?), 17, 20, 52, 53, 77, 93, 155 and 165 were identified. Races 17 and 52 were predominant. Using the wheat Sizilianischer Binkel [Sicilian club], some subraces were distinguished.

1769 BASILE, R.
Relazione quinquennale (1953–1957) sulle razze fisiologiche di *Puccinia recondita* Rob. ex Desm. [= *P. rubigo-vera* (DC.) Wint. f. sp. *tritici* (Erikss.) Carl.], in Italia. [**Quinquennial report (1953–57) on the physiologic races of *P. recondita* Rob. ex Desm. (= *P. rubigo-vera* [DC.] Wint. f. sp. *tritici* [Erikss.] Carl.) in Italy**].
Boll. Staz. Pat. veg. Roma 1959 : **17** : 127–40.

Tabular data show the distribution of the races in the period as a whole and in the individual years. The race of most frequent occurrence was race 176, not previously reported for other parts of the world.

1770 BASILE, R., SPEHAR, V. & KOSTIC, B.
Identification of some physiologic races of *Puccinia graminis* var. *tritici*, isolated from *Berberis vulgaris* L. in Yugoslavia, during 1959.
Robigo, Castelar 1960 : No. 10 : 37–39; also in Italian, 33–35 and Spanish, 36–37. (Mimeographed).

Races 40 and 215 were identified in barberry leaf ecidia collected at various centres in Yugoslavia.

1771 JOHNSTON, C. O.
Physiologic races of leaf rust of wheat, *Puccinia recondita* Rob. ex Desm. f. sp. *tritici* in the United States in 1959.
Plant Dis. Reptr. 1960 : **44** : 778–79.

Of 23 races identified from 402 leaf rusts collected from 33 states, race 15 was the most abundant (50·6% of all isolates) followed by races 2 (11·4%), 5 (9·4%) and 122 (8·6%). The other races did not exceed 3·0% and races 1, 131, 69 and 143 were isolated only once each.

1772 SILVA, R. DA, COELHO, E. T. & SILVA, A. V. DA
Identification of races of the wheat leaf rust in Brazil, using a new group of varieties.
Robigo, Castelar 1960 : No. 10 : 12–17; also in Portuguese, 7–12 and Spanish, 17–22. (Mimeographed).

Data collected over a 5-year period in southern Brazil provide information on the prevalence and geographical distribution of 24 races of *Puccinia triticina*. A group of nine Argentine and Brazilian varieties was used for identification purposes.

1773 CENÓZ, H. P.
Resistant wheats to the physiologic races of the "leaf rust" (*Puccinia recondita*) most common in the Argentine cereal region.
Robigo, Castelar 1960 : No. 10 : 24–25; also in Spanish, 22–24. (Mimeographed).

Tabulated information is given on the reaction of eight winter-wheat varieties and 40 spring wheats to the races 2 Arg., 20 Arg. and 20L Arg. A number of lines obtained from the USA were resistant to all three races.

1774 BAHL, P. N. & KOHLI, S. P.
Inheritance of seedling resistance to some Indian races of yellow rust in intervarietal crosses of *Triticum aestivum*.
Indian J. Genet. 1960 : **20** : 42–47.

The resistance of Cometa Klein to each of races 13 and H of *Puccinia glumarum* was found in crosses with the susceptible variety Ridley to be controlled by two different complementary gene pairs, dominant in Cometa Klein and recessive in Ridley. Resistance to each race is determination by the double dominant condition.

The resistance of Rio Negro to race 13 was found in crosses with the susceptible PbC518 to be dependent on the interaction of two gene pairs *RR* and *II*. *RR* confers resistance while *II* inhibits its action and induces susceptibility. The constitution proposed for the resistant parent is *RRii* and that for PbC518 is *rrII*.

1775 RAO, M. V. & AGRAWAL, R. K.
Inheritance studies in wheat—V. Inheritance of seedling reaction to physiologic races 40 and 75 of stem rust in some intervarietal crosses of *Triticum aestivum*.
Indian J. Genet. 1960 : **20** : 48–52.

The present studies indicate that NP790 and E1913 [(Kenya-Gular-Pilot) x (K58-Newthatch)] both carry one dominant gene pair for resistance to *Puccinia graminis* var. *tritici* race 40 and two duplicate gene pairs for resistance to race 75.

Reference is made to unpublished studies made at the Indian Agricultural Research Institute; these include the findings that: (1) E1913 has dominant monogenic resistance to races 42 and 42B, and NP790 has dominant monogenic resistance to race 42B [cf. 1776]; (2) dihybrid ratios occurred in the progenies from crosses of NP790 (resistant) with varieties susceptible to race 21; and (3) two pairs of dominant duplicate genes condition resistance to races 24 and 117 in NP790.

1776 Rao, M. V. & Agrawal, R. K.
Inheritance studies in wheat—VI. Inheritance of seedling reaction to physiologic race 42 and biotype 42 B of stem rust in some intervarietal crosses of *Triticum aestivum.*
Indian J. Genet. 1960 : **20** : 53–57.

The resistant varieties were each found to carry one dominant gene for resistance to *Puccinia graminis* var. *tritici* race 42 and one dominant gene for resistance to the biotype 42B. Resistance to this biotype was controlled by two dominant duplicate factors in the variety Kenya 184P2AIF.

1777 Loegering, W. Q. *et al.*
A proposed modification of the system of wheat leaf rust race identification and nomenclature.
Robigo, Castelar 1960 : No. 10 : 2–4; also in Spanish, 4–7. (Mimeographed).

The role of test varieties, supplementary differentials and standard differentials in the identification of leaf-rust races is discussed briefly.

1778 Samborski, D. J. & Peturson, B.
Effect of leaf rust on the yield of resistant wheats.
Canad. J. Pl. Sci. 1960 : **40** : 620–22.

In a test at Winnipeg, Man., heavy natural infection of leaf rust initiated at an early stage of plant development substantially reduced the yield, kernel weight and bushel weight of susceptible Thatcher, moderately resistant Selkirk and the highly resistant hybrids Thatcher^7 x Frontana and Selkirk^8 x Exchange. Yield loss in Thatcher was 58%, while in the other three wheats it ranged from 12 to 28%. The results were indicative of a direct relationship between density of inoculum, as influenced by proximity of susceptible plants, and the amount of necrosis on resistant varieties.

1779 Allan, R. E., Heyne, E. G., Jones, E. M. & Johnston, C. O.
Genetic analyses of ten sources of hessian fly resistance, their interrelationships and association with leaf rust reaction in wheat.
Tech. Bull. Kans. agric. Exp. Sta. 1959 : No. 104 : Pp. 51.

A study of selections from crosses made during the Kansas wheat breeding programme has indicated that at least three partially dominant factors and five recessive factors govern resistance to *Phytophaga destructor* in the varieties involved. The following seven selections were found to possess H_3, the Illinois 1 factor: IVcl-Comanche x Pawnee-Comanche, sel. Ks. 472941; Pawnee x PI94547–1, sel. Ks. 52392; Pawnee x PI119358, sel. Ks. 52381; Chiefkan-Hard Federation-Kawvale x PI119344–7, sel. Ks. 52400; Pawnee-Triumfo, sel. Ks. 52369; Pawnee x PI119344–7, sel. Ks. 52391; and Mediterranean Hope-Pawnee x Oro-Illinois 1-Comanche, CI12804. The same selections appeared to possess the h_4 factor and there was evidence that H_3 and h_4 are either identical, alleles, or pseudoalleles, when the plants were studied for reaction to the Great Plains race of the Hessian fly. Pawnee–Ribeiro, sel. Ks. 52357 possesses the H_5 factor of Ribeiro, PI56206–8–1, as well as a minor factor, or factors, derived from Pawnee. Pawnee-PI94587, CI12855, possesses a single partially dominant factor, H_6, different from any previously reported. There was evidence that some minor factors were also involved. Studies with Ponca indicated that possibly three different recessive factors govern resistance to the Great Plains Hessian fly in this variety and its derivatives. Greenhouse investigations with the cross Bison x Pawnee indicate that Pawnee may possess two other recessive factors that govern resistance to the insect. In the cross Bison x sel. Ks. 52400, a single partially dominant factor controlled resistance to both the eastern and Great Plains populations of the Hessian fly. The inheritance of resistance to leaf rust, *Puccinia recondita*, was studied in the F_4 generation of three crosses. The results showed that Pawnee possesses a partially dominant factor that governs resistance to races 9 and 11. Selection Ks. 52400 possesses a partially-dominant factor for resistance to races 5, 9 and 15. In tests involving reaction to race 5, this factor, which is carried on chromosome XIV, was found to be linked with the partially dominant factor for Hessian-fly resistance, with a recombination value of 7·20 + 1·10%.

1780 Curtis, B. C., Schlehuber, A. M. & Wood, E. A. (Jun.)
Genetics of greenbug (*Toxoptera graminum* Rond.) resistance in two strains of common wheat.
Agron. J. 1960 : **52** : 599–602.

A detailed report is given of investigations which have shown that the resistance of Dickinson Selection 28A and CI9058 to *T. graminum* depends upon a single pair of recessive genes, *gbgb* [cf. XXX, 1215].

BUCKWHEAT

1781 Nettevič, Ė. D.
(Selectivity of fertilization in vegetative-sexual hybridization of buckwheat).
Agrobiologija (Agrobiology) 1959 : No. 4 : 533–39. [Russian].

This report on Mičurinist experiments with buckwheat gives several examples where the preference of a variety, employed as ♀ parent, for a definite kind of pollen was modified by grafting it, previously to crossing, on another variety. Grafting helped to overcome incompatibility in some wide crosses and the progeny from vegetative-sexual hybridizations differed in the mode of inheritance of characters from that of normal sexual hybrids from identical crosses. The stocks included *Polygonum weyrichii*, *Fagopyrum tataricum* and Chinese buckwheat, besides the diploid and tetraploid forms of ordinary buckwheat.

1782 Žebrak, E. A.
(Embryogeny in diploid and tetraploid buckwheat).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **135** : 475–77. [Russian].

The development of the embryo and endosperm in tetraploid buckwheat was slower than in the diploid form and was responsible for the later seed maturation of the former.

OATS

1783 Bell, R. A. M.
Spring oat variety trials, 1954–58.
J. nat. Inst. agric. Bot. 1959 : **8** : 603–13.

The results of 54 tests carried out mostly in England and Wales to study Manod, Nestor, Zandster, 16004 (Flämingsgold x Bambu I) and 4757/6/2/19 (Tama x 01751/11), with Sun II as control, are reported.

1784 Dent, J. W.
The composition and yield of the spring oats Radnorshire Sprig, Maldwyn and Sun II, grown for fodder under upland conditions.
J. nat. Inst. agric. Bot. 1959 : **8** : 614–24.

Trials of Radnorshire Sprig, Maldwyn and Blenda (not Sun II as in the title of paper), grown at centres in England and Wales, are described.

1785 Mengersen, F.
Oat improvement in N.S.W. I. Early history and development. II. Development of new varieties in southern New South Wales.
Agric. Gaz. NSW 1960 : **71** : 449–61.

Reference is made to the achievements of Pridham, the breeder of the Sunrise, Lachlan, Mulga, Guyra, Bond and Belar oat varieties. The following varieties are described: Ballidu, Dale, Orient [cf. XVIII, 160], Acacia [XXII, 309], Avon [XXV, 2888] and Fulmark [XXVIII, 4126]. A number of problems currently under investigation in New South Wales are outlined.

1786 Kisljuk, M. M.
(Variability of oats after exposure to temperatures below zero).
Agrobiologija (Agrobiology) 1959 : No. **4** : 512–19. [Russian].

The heritable basis of the oats Orel [Eagle] and Zolotoj Dožd' [Golden Rain] was shattered by subjecting young plants to temperatures below zero for several generations at the Institute of Plant Industry. The resulting progenies segregated for morphological and biological characteristics. Some of the new forms bred true, others continued segregating. They included winter forms, and biotypes which outyielded the initial variety, exceeded it in winter hardiness or differed from it in time of maturity. Some experimental plants gave rise to fatuoids.

1787 Murphy, H. C.
Registration of oat varieties, XXII.
Agron. J. 1960 : **52** : 663–65.

The following varieties, recently registered cooperatively by the US Department of Agriculture and American Society of Agronomy, are described: Aja [cf. XV, 813]; Clarion [XXVI, 263]; Garry [cf. XXVI, 2260]; Moregrain [(Arlington-Delair x Trispernia) x (Bond-Fulgham x Victorgrain)] [cf. XXIX, 2547]; Rodney, developed from [(Hajira-Banner x Victoria) x (Victory x Hajira)] x Roxton [cf. XXV, 1711]; Simcoe [cf. XXIV, 1735]; Macon [cf. XXIX, 3759; Curt [cf. XXX, 3828 and XXXI, 351]; and Nehawka, selected from Cherokee [cf. XX, 323].

1788 Pfeifer, R. P. & Kline, J. P.
A major cause of winterkill of winter oats.
Agron. J. 1960 : **52** : 621–23.

In a study of varieties autumn-sown in flats placed in the soil under field conditions at University Park, Pa., winter killing was related to the temperature of the soil at a depth of

1 in. Some killing occurred in hardy varieties when the soil temperature fell below 22° F. With a soil temperature of 11° F., all varieties were killed. Hardiness in resistant varieties was associated with early growth; limited growth caused by late sowing predisposed the seedlings to killing. Laboratory tests confirmed that winter killing and soil temperature were associated and that hardiness developed during early growth. For plants 10 days old, differences in survival between spring and winter types were significant. Differences between semi-winter-hardy and hardy varieties were not however significant until the plants were 45 days old. The results are discussed with reference to the development of a laboratory technique for testing hardiness in breeding.

1789 SECHLER, D. T.

A study of some plant characters associated with resistance to root lodging in oats.

Diss. Abstr. 1960 : **21** : LC Card Mic 60–2099 : 29–30. (Abst.).

The lodging-resistant varieties Mo. 04635 and Burnett had significantly longer root crowns, and culms and roots with greater diameter and lower top : root ratios than the susceptible varieties Mo. 04649 and Columbia when grown under similar conditions. Lodging was not associated with number of coronal roots or chemical content of the roots. The only significant variety-environmental interaction was for the effect of depth of sowing upon length of root crown. Varieties with a potential for the formation of a long crown did not express this character with shallow sowing. Crown length appeared to have a complex mode of inheritance. A minimum difference of three genes between Columbia and Mo. 04635 is suggested. According to data from the same cross, at least two minor genes and one major one determined culm diameter. Heritability of other root characters appeared to be very low. F_2–F_3 correlations were positive for number and diameter of coronal roots but not significant at the 5% level. F_2–F_3 correlations for culm diameter and root-crown length were positive and significant at the 5% level. The implications of the results for selection are indicated.

1790 TURNER, E. M. C.

The nature of the resistance of oats to the take-all fungus. III. Distribution of the inhibitor in oat seedlings.

J. exp. Bot. 1960 : **11** : 403–12.

Further investigations [cf. XXIV, 1053] have shown that the inhibitor of growth and respiration of *Ophiobolus graminis* in the roots is fluorescent in ultraviolet light while the inhibitor from the leaves is nonfluorescent. In other respects, the two inhibitors behave similarly; it is suggested that they differ only in the structure of a part of the molecule not concerned in its biological activity. The inhibitor is present in a much higher concentration in the roots.

1791 WALLACE, A. T.

The frequency of induced mutations at a specific locus in oats.

Genetics 1960 : **45** : p. 1016. (Abst.).

Seeds of Victorgrain, which is susceptible to *Helminthosporium* (*Cochliobolus*) *victoriae*, were exposed to γ rays from Co^{60}. X_2 germinating seeds were treated with toxin produced by the fungus and resistant seedlings selected. The rates of mutation did not increase linearly with increasing dosage and were not influenced by the range in intensity (20 r.–4.5 kr. per min.), but were affected by the moisture content of the seed at the time of irradiation.

1792 NELSON, R. R.

***Cochliobolus victoriae*, the perfect stage of *Helminthosporium victoriae*.**

Phytopathology 1960 : **50** : 774–75.

The perfect stage (*C. victoriae*) of *H. victoriae* has been obtained. Genetical studies of pathogenicity, toxin production and other problems are therefore now possible.

1793 IVANOFF, S. S.

Differentiation of oat helminthosporia by the ragdoll method.

Plant Dis. Reptr. 1960 : **44** : 538–42.

By means of a technique described earlier [cf. XXII, 1844] the disease symptoms induced by *H. victoriae* (*Cochliobolus victoriae*) and *H. avenae* (*Pyrenophora avenae*) can be clearly differentiated. Using this technique it was found that none of 29 *Helminthosporium* isolates tested could induce Victoria blight symptoms in the resistant varieties Mid-South and Southland. These results are in contrast with Earhart's findings [cf. XXX, 2573] and the lack of agreement is thought to be mainly due to the difficulties encountered in classifying isolates and in differentiating between Victoria blight and leaf blotch symptoms; some cultures classified by Earhart as *H. victoriae* seemed to be closer to *H. avenae* and induced leaf blotch symptoms and not Victoria blight. It is concluded that the ability to induce well-defined disease symptoms should be one of the chief bases of classifying these fungi.

1794 Clark, R. V. & Zillinsky, F. J.
Varietal reaction of oats to the Septoria disease under field and greenhouse conditions.
Canad. Pl. Dis. Surv. 1960 : **40** : 1–9.

Varieties of *Avena sativa* showed very little resistance to *Leptosphaeria avenaria* in field and greenhouse tests in Canada. A few varieties had some tolerance in the field but when tested in the greenhouse with a highly virulent macrospore inoculum, little difference in tolerance was found between these varieties and the more susceptible ones. In both the field and greenhouse, some derivatives of *A. brevis*, *A. nudibrevis*, *A. strigosa* and *A. wiestii* were considerably more resistant than *A. sativa*, resistance being expressed as a much slower development of the disease. Preliminary results suggested that use of ascospores as inoculum may be a better means of screening varieties in greenhouse tests than macrospore inoculations, the range in reaction being wider with the former type of inoculum.

1795 Holton, C. S. & Dietz, S. M.
An apparent association of haploid lethal factors with two unique sorus types of oat smut.
Phytopathology 1960 : **50** : 749–51.

In a biotype of *Ustilago avenae* and another of *U. kolleri*, lethal factors preventing haploid growth of the sporidia on a culture medium were associated with sorus type.

1796 Holton, C. S. & Halisky, P. M.
Dominance of avirulence and monogenic control of virulence in race hybrids of *Ustilago avenae*.
Phytopathology 1960 : **50** : 766–70.

Avirulence was dominant in nine hybrids involving seven races, the dominance being complete in the majority of cases and almost complete in the remainder. F_2 data showed virulence on a given host to be monogenic. The gene pairs responsible for virulence on the four varieties studied, viz. Anthony, Gothland, Monarch and Camas, were respectively designated *aa*, *gg*, *mm* and *cc*. Recombination in hybrids derived from race A–5 (*aaggMMCC*) x race A–7 (*aaggmmcc*) resulted in types differing from either parent in virulence, a possible mode of evolution of new races thus being suggested.

1797 Burrows, V. D.
Nature of the resistance of oat varieties to races of oat stem rust.
Nature, Lond. 1960 : **188** : 957–58.

Evidence from experiments on "leaf sandwiches" of different combinations of leaves from resistant and susceptible varieties suggested that resistance to *Puccinia graminis* var. *avenae* is not attributable to failure of a resistant variety to supply the factors necessary for growth of the pathogen, but rather to some specific type of inhibition, the nature of which has not been determined. The inhibition did not appear to be operative beyond the resistant tissue because the mycelium was capable of migrating from this tissue to a susceptible leaf and of growing vigorously in it. This finding suggested that the inhibition arose through interaction of the mycelium and host cells.

1798 Simons, M. D. & Michel, L. J.
Physiologic races of crown rust of oats identified in 1959.
Plant Dis. Reptr. 1960 : **44** : 780–82.

The prevalence and distribution of crown rust races in the United States in 1959 are reported. Twenty-one new races have been isolated throughout the world since 1958, 20 of them (numbers 300–319) in Israel. Most of the Israel isolates attack Santa Fe and Bondvic, and more than half attack Trispernia. Landhafer however is resistant to most of these races. A few attack both Landhafer and Santa Fe but none resembles the North American race 298. Race 320 was identified in New York; however, most of the varieties now being used as sources of resistance are resistant to this race. The reactions of eight supplementary differential varieties are described. CI4727, a strain of *Avena sterilis* thought to be resistant to race group 290, was attacked by the majority of isolates of this group during 1959.

1799 Sadanaga, K., Murphy, H. C. & Grindeland, R.
Inheritance of stem rust resistance of C.I.7232, a derived tetraploid oat.
Phytopathology 1960 : **50** : 779–81.

Resistance to *Puccinia graminis* var. *avenae* races 7, 7A and 8 was found to be conditioned by a single dominant gene in CI7232. This gene differs from genes *A*, *D*, *BC*, and *E* reported in cultivated hexaploid oats [cf. XXIX, 1131].

1800 **Breeding for rust-resistant oats.**
Agric. Res., Wash. 1960 : **9** : No. 1 : 6–7.

Saia, a diploid possessing resistance to all known races of crown rust in the USA, was crossed with a tetraploid oat. Tetraploid Aberdeen 101, derived from a completely fertile, resistant F_3 plant, was crossed with cultivated oats. By back crossing the few self-sterile plants thus obtained with disease-resistant types, material combining the desirable characteristics of the cultivated parents with the crown-rust resistance of Saia has been developed.

1801 Brown, C. M. & Jedlinski, H.
Breeding oat varieties resistant to yellow dwarf.
Ill. Res. 1960 : **2** : No. **4** : p. 16.

Albion, which is resistant to barley yellow dwarf virus (BYD) but is otherwise an undesirable variety, is being crossed with standard varieties, such as Clintland, Fayette, Goodfield and Newton, in an effort to produce well-adapted, BYD–resistant oat varieties.

RYE

1802 Nürnberg-Krüger, U.
Cytogenetische Untersuchungen an der Gattung *Secale* L. **(Cytogenetical investigations on the genus *Secale* L.).**
Z. Pflanzenz. 1960 : **44** : 63–72.

The results of many interspecific crosses are reported. Hybrids within the *Cerealia* section were fully fertile and often showed heterosis in characters such as tillering, straw length and seed set; they resembled the parents in having seven ring bivalents at diacinesis of pollen meiosis. Crosses within the *Agrestes* section were also fertile and showed heterosis in vegetative characters. Both parents and hybrids set less seed than those of the *Cerealia* section. Bivalents of *S. africanum* and *S. vavilovii* and their hybrids showed loosening in their end attachments and often appeared open; the other plants in the *Agrestes* group resembled the *Cerealia* cytologically. Hybrids between the two sections did not differ greatly in vegetative characters from the hybrids within sections. Pollen viability and seed set were reduced in the intersectional hybrids, which showed four ring bivalents and some chains or rings of six chromosomes at diacinesis; these chains tended to break up into univalents or bivalents in the hybrids with *S. africanum* and *S. vavilovii*. It is concluded that the two sections differ by two reciprocal translocations. The *Agrestes* chromosome complement is always accompanied by full brittleness of the ears, small grains and colour dimorphism in the grains but no perennation. Crossing perennial species sometimes produced annual species. In agreement with Roževic's phylogenetic scheme, it is thought that *S. sylvestre* should be put in a section by itself and *S. vavilovii* should be taken from the *Cerealia* and associated with *S. kuprijanovii*.

1803 Kojnov, G. M.
(A contribution to the improvement of rye in Bulgaria and the method of breeding rye).
Nauč. Trud. visš. selskostopan. Inst. V. Kolarov (Sci. Trans. V. Kolarov high. agric. Inst.), Plovdiv 1957–1958 (1959) : **6** : 7–30. [Bulgarian].

The new varieties Kolarov 1 and 2 were both obtained by a method combining intervarietal open pollination, single-plant and family selection and continuous negative selection of the resultant hybrid population. The initial material comprised an unidentified Bulgarian land variety, Petkus and single-plant selections of the Bulgarian cultivars 57, 59, 362 and 600.

1804 Bauer, F.
A rozs nemesítésének helyzete a Duna-Tisza közén. **(The position of rye breeding in the area between the Danube and Tisza).**
Agrártudomány 1960 : **12** : No. **5** : 17–20.

The variety Kecskemét h., developed in Hungary by selective fertilization of Petkus, has given good yields and is particularly suited to the blown-sand area between the Danube and the Tisza. An attempt to introduce earliness by back crossing with early varieties is now in progress and a programme of reciprocal recurrent selection for the development of heterotic material is under way.

1805 Barnes, B. S. & Wells, D. G.
Explorer—a new rye for Mississippi.
Bull. Miss. agric. Exp. Sta. 1960 : No. 600 : Pp. 7.

Detailed information is given on the above leaf-rust resistant synthetic [cf. 363].

1806 Rees, H. & Naylor, B.
Developmental variation in chromosome behaviour.
Heredity 1960 : **15** : 17–27.

"Differences in chromosome behaviour between cells are shown to be a useful index of the developmental variation occurring within a tissue. For two characters investigated in rye p.m.c., namely chiasma frequency and the timing sequence of meiotic divisions, well defined patterns of variation are demonstrated within anthers. Variation in both characters is probably influenced by the system of distribution of nutrient or other substances to the anther during its development.

"The pattern of development variation in chiasma frequency is more consistent in anthers of heterozygous than homozygous plants.

"Timing and chiasma frequency are related; p.m.c. reaching metaphase early have higher chiasma frequencies than those at metaphase later.

"Another factor affecting chiasma frequency variation within an anther is competition for chiasmata between different regions."

[Authors' summary].

1807 Hrishi, N. J. & Müntzing, A.
Structural heterozygosity in *Secale kuprijanovii*.
Hereditas, Lund 1960 : **46** : 745–52.

Meiosis was studied in 13 plants, raised from seed of a strain which originated from Transcaucasia. Eleven were heterozygous for a segmental interchange, the most frequent configuration being $1_{IV} + 5_{II}$. In the other two individuals, no multivalents were observed, bivalent pairing being regular or almost regular. Pollen fertility in the structural heterozygotes had an average value of 80% and was significantly correlated with the frequency of zigzag arrangement in the quadrivalent. One of the plants lacking the quadrivalent was completely male sterile, but the other had 85% good pollen. On the basis of the data at present available, no conclusion concerning the mode of maintenance of the structural heterozygosity may be drawn.

1808 Ostanin, A. M.
Crearea insuşirilor de toamnă sau de primăvară la formele de secară biologic deosebite. **(Developing winter or spring habit in biologically different forms of rye).**
An. Romîno-Soviet. : Ser. Agric.-Zooteh. 1959 : **13** : No. **6** : 42–53.

[Cf. XXX, 3853].

1809 Surikov, I. M.
(The variability in expression of incompatibility in rye).
Ž. obšč. Biol. (J. gen. Biol.), Moskva 1960 : **21** : 270–78. [Russian].

White Russian studies of self incompatibility in clones and populations of Vjatka and Petkus are described. The clones were self incompatible to a high degree, but a few ears from a large number of plants of all clones set grains on selfing. There were no completely self-sterile forms in the populations but differences were observed in the degree of self fertility. It is thought that the plants with the least degree of self compatibility were homozygous for either the *S* or *Z* gene, the others being heterozygous. The observed distribution of degree of self fertility deviated significantly from a Poisson distribution, there being a larger number of individuals than expected in the relatively self-fertile classes and fewer in the self incompatible; the deviations were greater in both clones and populations with the higher degrees of self fertility. Occasional ears with up to 42–43 grains were found in both varieties. The deviations were somewhat more pronounced in populations than in the clones and are ascribed to the mutation of the gene S to S^b; the frequency of mutation is calculated as 2×10^{-7}, which is of the same order as that given by other authors.

1810 Vožda, J.
Vliv různých způsobů opylení na metabolismus fosforu v generativních orgánech žita. **(The effect of different modes of pollination on the phosphorus metabolism in the generative organs of rye).**
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1535–46.

On stigmas of rye, pollen from another rye plant germinated quickly whilst self pollen and pollen from other species germinated slowly and the pollen tubes did not complete normal development. The content of phosphorus in the stigmas and ovaries increased when spring rye was pollinated by various cereals and grasses, the increase varying with the type of pollen. Pollination by *Plantago major* had no effect on phosphorus content. Changes in phosphorus metabolism in the generative organs were also brought about by indole-3-acetic acid, ascorbic acid, nicotinic acid and an aqueous pollen extract.

MAIZE

Eucarpia. First Meeting of the Maize Section. Rome 1960 : Pp. x + 45. (Mimeographed).

1811 *Knoll, J. G. The work of FAO in the field of crop improvement.* (*pp.* 4–7).

The following FAO projects are discussed: cooperative programmes in rice breeding, the Near East wheat and barley project, the publication of the World Genetic Stocks Catalogue and the World List of Plant Breeders, the formulation of minimum seed certification standards for hybrid maize and other cereals, and the World Seed Campaign.

1812 *Rinke, E. H. Breeding for yield components in maize.* (*pp.* 13–14). (*Abst.*).

A plan for the simultaneous improvement of number of ears, ear length, kernel depth, number of kernel rows and starch density in a single inbred line is illustrated.

1813 *Rinke, E. H. Breeding maize for desirable responses to high plant populations. (p. 15). (Abst.).*

It is suggested that it should be possible to select for desirable hybrid-population response by first selecting for desirable inbred-population response. Such a procedure should enhance the efficiency of the breeding programme.

1814 *Popow, G. & Lanini, F. Pop x dent hybrids. (pp. 15–18).*

The results are reported of a pop x dent breeding programme which commenced in 1956. From selected combinations of pop and dent lines, new hybrids were produced which were significantly earlier and equal in yield to Ohio M34 and equal in standing ability to Wisc. 641AA. The most promising pop inbred lines are Jo53, Jo64 and 472–3A. On the dent side, the following inbreds formed the most favourable combinations: B 14, 21 and 37; Oh 43, 43E, 45 and 51A; and M14, MS1334 and W22. Certain theoretical problems raised by the programme are discussed briefly.

1815 *Schnell, F. W. Some aspects of recurrent reciprocal selection. (pp. 18–22).*

Included in this discussion of theoretical and some practical aspects is a comparison of recurrent reciprocal selection with recurrent selection for specific combining ability. It is shown that for loci where dominance is far less than complete, reciprocal selection will be the better method, while for loci at which dominance is complete or nearly so, selection for specific combining ability would be more efficient.

1816 *Jugenheimer, R. W. Breeding for oil and protein content. (pp. 23–25).*

Two new maize hybrids, Ill.6021 and Ill.6052, have been selected at the University of Illinois for high oil and protein content. Over a 5-year trial period, they averaged 30% more oil and 10% more protein than the standard variety US13.

1817 *Blanco, M. & Blanco, J. L. Breeding for high sugar in the stalk at maturity and related subjects. (pp. 25–28).*

The authors draw attention to the possibilities of maize as a sugar crop and discuss certain advantages that they consider it possesses over sugar beet, such as higher potential sugar yield, shorter growing period, higher value bagasse, higher percentage sugar in the crop and easier breeding. A number of possible relationships between sugar content and other plant characters are discussed briefly.

1818 *Lööf, B. Maize breeding under very northern conditions. (pp. 28–32).*

In 7-year trials at Svalöf, Sweden, greater yields of silage were obtained from three Wisconsin hybrids 240, 335 and 464 than from the control variety Eagle Hill. The problems and aims of maize breeding in Sweden are discussed.

1819 *Rinke, E. H. Maize evaluation for resistance to leaf feeding by the European corn borer* (Pyrausta nubilalis). *(pp. 36–38). (Abst.).*

A technique developed at the University of Minnesota is described.

1820 *Wellhausen, E. J. Variation of maize in Mexico and Central America. Its present and future utilization. (pp. 38–45).*

The history of maize improvement in Mexico is outlined and achievements up to the present are illustrated by a comparison of the yield of common and selected open-pollinated varieties, synthetic varieties and hybrids in the four major maize-growing zones of Mexico. It is pointed out that before further major gains may be expected, it will be necessary to increase the yield potential of open-pollinated varieties, from which future hybrids can be produced. Evidence from recent trials is presented which illustrates that this may be accomplished by the judicious and systematic blending of unrelated races. Thus in a trial in the Bajío area, the cross Ixtac x V–520–C (race Conico x race Tuxpeño), yielded 27% more than H353, the highest yielding hybrid yet produced for that region. Nine other interracial crosses also outyielded H353. Crosses between certain inbred lines of different races have also given good results. In a trial in the Central Mesa region, H125, one of the best hybrids being distributed in central Mexico, was outyielded by 29–33% by three 3-way crosses; these were derived from crosses between the races Celaya and Tuxpeño in combination with a single cross of lines from the races Chalqueño and Conico Norteño. The author emphasizes the need for further study on the origin and relationships of maize races throughout the American continent and for the identification and isolation of superior gene plasm. The relevance of these developments to maize breeding in Europe is discussed briefly.

1821 KOZUBENKO, V. E.
(Problems of maize breeding).
Kukuruza (Maize) 1959 : No. 9 : 43–46.
[Russian].

The breeding of maize for high yield, earliness, drought resistance, tolerance of low temperatures and increased contents of protein, fat and vitamins in the Ukraine is discussed.

1822 Eckhardt, R. C.

Report of the Thirteenth Southern Corn Improvement Conference held in Athens, Georgia, August 20–22, 1957 : Pp. 55. (Mimeographed).

The first discussion, led by J. W. Ingram, dealt with maize resistance to insect attack; the report includes a list of the earworm injury on 37 hybrids and inbreds, as compared with injury suffered by standard hybrids. Another table, presented by C. C. Bickenstaff and associates, gives details of the performance of 34 southern inbred lines in nearly all possible single-cross combinations. These lines had been chosen by breeders as their most earworm-resistant material and are now being used in a recurrent selection programme for improved resistance. In a feeding test, in which maize earworm larvae were reared on silks and kernels from highly resistant lines, susceptible lines and single crosses within and between these two groups, no direct antibiosis was exhibited by any entry, nor were there any differences between group averages in percentage mortality, duration of larval stage and pupal weight; there were, however, substantial differences between individual lines. Further work on shoot bag treatments is reported [cf. XXVII, 1717].

Data on the resistance of 11 maize lines to the sugar-cane borer are reported by K. D. Arbuthnot and J. S. Rogers. K. D. Arbuthnot and J. S. Brooks report on progress in evaluating resistance to the southwestern corn borer, on the basis of foliage damage readings before tassel emergence; using this method, the selection of plants with improved resistance is facilitated.

Complications that arise in breeding for resistance to the European corn borer because of the existence of two broods are discussed by F. F. Dicke; 11 southern inbred lines found resistant to the first brood are listed.

C. O. Grogan and M. S. Zuber present the results of preliminary studies on the determination of stalk lodging resistance by a mechanical crushing technique.

The selection programme of lines with resistance to *Helminthosporium* blights is continuing. G. Kozelnicky states that the reactions of an inbred line to *Diplodia zeae* and to *D. macrospora* are identical. Resistance to *D. zeae* appears to be conditioned by two or more genes. Hetero-fertilization and other abnormalities occurring in the inbred line GT112 are discussed.

Tabulated information is presented by A. A. Fleming on the performance of a large number of early, midseason and late three-way crosses, and on the damage by the European corn borer and the percentage of unsound ears in 41 inbred lines grown at Stoneville, Miss.

C. F. Genter, in a report on progress at the Virginia station, states that a synthetic made from a mixture of southern and Corn Belt plasm has shown considerable promise as source material for inbred lines. The hybrid (WF9 x T8) (Oh43 x K155) has been released as VPI653. Certain South American lines have shown some resistance to *Helminthosporium turcicum* (*Trichometasphaeria turcica*) in south Florida, according to a report by W. J. Wiser, while African inbreds, resistant to both *H. turcicum* and *H. maydis* (*Cochliobolus heterostrophus*) are being used in Tennessee breeding programmes.

Progress achieved in recurrent selection programmes in Florida and Georgia is outlined by E. S. Homer and by L. F. Bauman, respectively. G. A. Lebedeff mentions the outstanding performance shown by the midseason hybrid Ga6029 (GE54 x T204–NC88 x GE62). G. A. Lebedeff and E. S. Luttrell note that no definite analysis of the genetic basis of susceptibility to bacterial stalk rot is yet possible because of the tendency for environmental influences to mask the genetic effects.

1823 Eckhardt, R. C.

Report of the Fourteenth Southern Corn Improvement Conference held in Athens, Georgia, January 13–14, 1959 : Pp. 59. (Mimeographed).

Several agronomic characteristics of dwarf hybrids are discussed by D. L. Thompson, while S. H. Yarnell deals with parthenogenesis in sweet corn; the latter may occur under the influence of high temperature and, possibly, high humidity as a result of the prevention of pollination during the normal season. General discussions of various aspects of maize breeding are contributed by E. B. Browne, G. F. Sprague, L. M. Josephson, J. W. Ingram (on entomological aspects) and R. R. Nelson (on mycological aspects).

Tabulated information is presented on tests involving a large number of hybrids in the following maturity categories: US13, Dixie 22 and Dixie 18. Details are given of work on the production of male-sterile material in several southern states.

1824 SPRAGUE, G. F.
Report of the Fourteenth Northeastern Corn Improvement Conference held in New York City, March 6 and 7, 1959 : Pp. 30. (Mimeographed).

In a report on the first year of a cooperative stalk-rot project involving ten inbred lines with promising resistance to stalk breakage, data are presented from New York, New Jersey, Connecticut, Pennsylvania and Ontario. Tabulated information is given on tests of hybrids in the following maturity series: 100 and 200; 300 and 500; 600 and 700; and 800 and 900.

The Maine hybrid (A96 x MS1341) (SD105 x WD) has now been registered as NE144. In comparison with other hybrids of the same maturity, it has shown superior yielding ability and equal or better stalk quality.

In a preliminary report on the performance of nine dwarf and six normal hybrids grown at several population levels, information is provided on individual and mean differences in grain yield and moisture content, lodging, breakage, stalk rot, weed population, percentage of damaged ears and percentage of well-filled ears.

G. F. Sprague discusses the present status of recurrent selection in maize breeding.

Report of Fourteenth Hybrid Corn Industry Research Conference held in Chicago, Illinois, December 2 and December 3, 1959.
Publ. Amer. Seed Tr. Assoc. 1959 : No. 14 : Pp. 157.

1825 *Penny, L. H. Improving combining ability by recurrent selection.* (*pp. 7–11*).

Recurrent selection techniques employed at Iowa State University are described and data from a number of trials utilizing the system are presented [cf. XXX, 354]. In one trial, the F_2 generation of the single-cross hybrid WF9 x B7 formed one of the original populations (C_0) for selection, while the other was a long-eared open-pollinated strain designated Alph. The inbred line B14 was used as a tester for both populations. The results showed that differences among the tester x bulk population crosses were very small in the WF9 x B7 portion of the study. However, the yield of the Alph C_2 x B14 cross exceeded that of the Alph C_0 x B14 cross by nearly 16 bushels per acre.

Substantial yield increases after two cycles of selection were obtained in another trial involving two populations, Stiff Stalk Synthetic and Corn Borer Synthetic. In this trial, each synthetic acted both as a population for selection and as a tester for the other synthetic. Certain aspects of recurrent selection are discussed. It is pointed out that the major problem limiting the effectiveness of the technique is not that of maintaining genetic variability but is rather the identification of genetically inferior plants within a population.

1826 *Collier, J. W. Three cycles of reciprocal recurrent selection.* (*pp. 12–23*).

The varieties Yellow Surecropper and Ferguson's Yellow Dent were used as the parental populations in a reciprocal recurrent selection programme in Texas. Substantial progress was obtained in yielding ability after the second and third cycles of selection; further, there was evidence that progress had been made in increasing the combining ability of each variety with respect to the other. There was still much variation available after three cycles of selection. Details are given on the rate of inbreeding and on the heritability of a number of the characters tested. The influence of environment on the effectiveness of selection is discussed.

1827 *Robinson, H. F. & Moll, R. H. Implications of environmental effects on genotypes in relation to breeding.* (*pp. 24–31*).

The results of a North Carolina study on the differential effects of varying environments on the phenotypic expression of genotypes are reported. Estimates of variance components from 60 Jarvis half-sib families tested for five years at five locations are given. The interaction variance of genotypes with environment was approximately one-half the magnitude of genetic variance. A large genetic-location-year interaction was obtained, reflecting the fact that the environmental changes causing genetic fluctuations were random in occurrence in the various locations and years of the study.

Investigations on aspects of genetic action related to the above study have been conducted on three open-pollinated varieties, the F_1 and F_3 of a cross between two of them, and segregating generations of two populations produced initially from crossing two inbred lines. From these studies, estimates of additive and non-additive genetic variances were made. The results indicated that additive gene effects were no less constant from one environment to another than nonadditive effects, under the conditions of these studies.

1828 *Kramer, H. H. Gene function and structure.* (*pp. 32–37*).

Recent studies by Beadle, Crick and others are discussed in this review of current concepts of gene function and structure.

1829 *Duvick, D. N. Genetic and environmental interactions with cytoplasmic pollen sterility of corn.* (*pp. 42–52*).
The various stages in a breeding programme utilizing male sterility are discussed. It is pointed out that there are numerous phases in the development of male-sterile hybrids where insufficient testing or inadequate knowledge of the genetic-environmental interactions involved can negate an entire breeding project, or "can result in the production of a potentially dangerous sterile female single cross or restored double cross".

1830 *Bauman, L. F. Environmental interactions with prolific hybrids.* (*pp. 53–59*). [Cf. XXX, 3910].

1831 *Sprague, G. F. Basic research in the Federal and State Corn Improvement Programs.* (*pp. 94–100*).
Information is given on the major problems in maize genetics currently being studied at State and Federal institutions in the United States.

1832 *Thompson, D. L. Breeding for low ear height.* (*pp. 134–38*).
It has been established that drought conditions may lead to a reduction in ear height of maize. However, nonsignificant correlations were obtained between ear height and yield in a tall hybrid, Dixie 82, and a short single cross, NC224 x NCSP24. This suggests that the moisture conditions during the period when ear height is determined do not markedly influence final yield. Some success is reported in selecting modifier genes for increasing ear height of dwarfs and in some cases an increase of 6″ has been obtained. As regards a suitable technique for ear height studies, tests showed that a satisfactory level of precision was obtained by measuring 10 plants per plot in 2 replications at 2 locations.

1833 *Moll, R. H. Quantitative genetics in corn and the implications to breeding methodology.* (*pp. 139–44*).
A study of the closeness between predicted and observed results of selection for higher yield has been conducted on four populations: two open-pollinated varieties, Jarvis and Indian Chief; the F_4 of Jarvis x Indian Chief; and the F_2 of the single cross CI21 x NC7. The predictions were, in general, relatively reliable, although there was a marked tendency for the predicted response to be higher than the observed response. This is attributed largely to genotype x environment interaction bias.

1834 Clapp, A. L. & Findley, W. R.
Kansas corn tests, 1959.
Bull. Kans. agric. Exp. Sta. 1960 : No. 419 : Pp. 32.
The results are reported of a series of maize trials conducted in Kansas in 1959. Also presented are details on the average performance of maize varieties over the two-year period, 1958–1959.

1835 Říman, L.
I.celostátní seminář o genetice, šlechtění, agrotechnice a patologii kukuřice. (**The first state seminar on the genetics, selection, agricultural technique and pathology of maize**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1447–51.
K. Hrubý spoke on Současné názory na vznik kulturní kukuřice [Contemporary opinions on the origin of cultivated maize]. O. Polerecký contributed Všeobecná kombinační schopnost u kukuřice [General combining ability in maize] and emphasized that in testing for general combining ability it is necessary to examine the "objective productivity" in crosses with at least two partners. Such tests should be carried out on the second and third selfed generations. Využití pylové sterility u kukuřice [The utilization of pollen sterility in maize] was the subject of K. I. Mostovoj's paper in which the importance of pollen sterility in breeding was stressed. L. Říman spoke on Poznatky z výzkumu vlivu cizorodého pylu na oplození kukuřice [Knowledge from research on the influence of foreign pollen on fertilization of maize] and made suggestions for future work on this topic. Zkušenosti z využití rostlinných haploidů v liniovém šlechtění kukuřice [Experience in the use of plant haploids in line breeding of maize] was the subject of J. Vožda's paper; the advantages of this method of breeding and some of the author's own results were mentioned. O. Mrázek contributed Zkušenosti se šlechtěním meziliniových hybridů kukuřice [Experiences in breeding interline hybrids of maize], discussing some of the practical problems. J. Vožda also spoke on Biologie opození kukuřice [The biology of maize fertilization], giving details of the process. Prodloužení životaschopnosti kukuřičného pylu [Prolonging the viability of maize pollen] was the subject of J. Poncová's paper in which different methods of conserving pollen were examined. R. Arnošt, in a paper

on Vliv různé doby výsevu na habitus některých samoopylených linií kukuřice [The influence of different times of sowing on the habit of some self-pollinated lines of maize], emphasized the importance of this topic and mentioned results of his own studies. K. I. Mostovoj dealt with Možnosti vyšlechtění mrazuvzdorné kukuřice [Possibilities of breeding frost resistant maize], mentioning results obtained in Czechoslovakia. J. Zajíček spoke on Zkušenosti s liniovými a odrůdoliniovými hybridy kukuřice [Studies with hybrids between lines and hybrids between varieties and lines of maize], discussing past and present work. Současná problematika šlechtění kukuřice na Slovensku a činnost Šlechtitelské stanice Topol'níky [Current problems of breeding maize in Slovakia and the activities of the Topol'níky Breeding Station] were K. Fojtík's topics; mention was made of the high quality hybrid seed being produced. V. Seget'a and M. Staněk contributed Chladuvzdornost kukuřice a patogenné organismy [Cold resistance of maize and pathogenic organisms]. P. Vítek discussed Návrh odrůdové rajonizace kukuřice pěstované na siláž [A project of varietal regionalization of maize cultivated for silage], mentioning that varieties have been classified according to their productivity and regional distribution; quality has also been studied. Všeobecná a speciální kombinační schopnost československých linií kukuřice [General and specific combining ability of Czechoslovak lines of maize] was A. Piovarči's topic and L. Slováková spoke on Metody klasifikace chladuvzdornosti kukuřičného materiálu [Methods of classifying maize for cold resistance], the importance of this work being stressed. G. Voždová contributed a paper on Využití umělé infekce při zkoušení kukuřice na odolnost vůči sněti [Using artificial infection for testing maize for resistance to smut], surveying the problems of this work and some of the results obtained; lines were classified according to resistance. O možnosti sérologických metod ke stanovení odolnosti odrůd kukuřice proti původci sněti—*Ustilago zeae* (Beck.). [Possibilities of serological methods for determining the resistance of maize varieties to smut, *U. zeae* (Beck.)] was the subject of E. Jermoljev's paper.

1836 Peterson, P. A.
Mutable gene control in maize.
Genetics 1960 : **45** : p. 1005. (Abst.).

As previously reported, a new mutable gene, a_1^m, arose in stocks carrying the pale green mutable gene pg^m [cf. XXVIII, 1394]. "The significant feature of this new mutable is its relationship to the pg^m system. It has been demonstrated that a_1^m is controlled by the inhibitor (I) which causes the A_1 allele to become colorless but, when I is removed by the Enhancer (En), the mutable kernel is characterized by dots of dark anthocyanin pigment on a nonpigmented colorless background. I and En are specific elements of the pg^m system. Thus, it is evident that a previously dominant allele, A_1, has become mutable because of the transfer of specific elements from the Pg locus to this new location, A_1. In a_1^m, a wide array of very distinct patterns (due to the timing and frequency of mutation events, i.e., late and early, high and low frequency and combinations of these) have been isolated. From these individually identifiable patterns other distinct patterns arise. Tests show that control of the pattern is intrinsic to the mutable allele itself." The mode of control of mutable-gene activity in maize is discussed in general. Such activity may be explained by a two-factor hypothesis, as in the case of the control of a_1^m by I and En, or a case such as control of the P^{vv} series by Mp may be interpreted by a one-factor or positional hypothesis.

1837 Schwartz, D.
Genetic studies on mutant enzymes in maize: synthesis of hybrid enzymes by heterozygotes.
Proc. nat. Acad. Sci. USA 1960 : **46** : 1210–15.

Three forms of an enzyme with esterase activity, found in the endosperm and seedling, were respectively characterized by fast, normal and slow migration rates in starch gel electrophoresis and were each under the control of an allele at locus E for esterase. The alleles were respectively designated E^F, E^N and E^S. Heterozygotes contained a hybrid enzyme in addition to the parental forms.

1838 Schwartz, D.
Electrophoretic and immunochemical studies with endosperm proteins of maize mutants.
Genetics 1960 : **45** : 1419–27.

Electrophoretic and immunochemical analyses indicated that Sh_1 controlled the formation of a major protein component in the endosperm. Neither this protein, nor a modified protein corresponding to it, was found in $sh_1sh_1sh_1$ endosperm. The amount of the protein increased with the dose of Sh_1. Suppression of Sh_1 by Ds resulted in the absence of the protein normally associated with Sh_1. Removal of Ds

from its position adjacent to Sh_1, under the influence of *Ac*, led to the reappearance of the protein whose production was controlled by Sh_1.

1839 ORTON, E. R. (JUN.).
Reconstitution of the variegated pericarp allele in maize by return of modulator to the P locus.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1502 : p. 4250. (Abst.).

Earlier work has shown that certain mutants with red self colour of the pericarp exhibit instability in expression of allele P^{rr}, in the form of variegated or nearly colourless sectors. Allele P^{vv} for variegated pericarp is believed to consist of P^{rr} and a transposable component *Mp* which, when present at locus *P* in conjunction with P^{rr}, inhibits the pigment-producing action of the latter. Evidence has been obtained that pericarp sectoring on self-red ears is the result of somatic mutation of P^{rr} to P^{vv}, through transpositions whereby *Mp* is returned to locus *P*. Rate of sectoring was directly related to the degree of linkage of transposed modulator (*tr–Mp*) with *P*. The majority of the reconstituted variegated mutants differed phenotypically from the standard medium-variegated type from which the original self-red variants arose. The various phenotypes of the reconstituted mutants could have been due to changes in the state of *Mp*, to increases in the number of *Mp* components or to different physical associations of *Mp* with P^{rr}. Pericarp sectoring in one group of closely-related families was not associated with the presence of *tr–Mp* in the genome; further study is required to determine the cause of this case of sectoring.

1840 GORSLINE, G. W.
Quantitative epistatic gene action in maize (*Zea mays*, L.).
Diss. Abstr. 1960 : **20** : LC Card Mic 59–6777 : p. 3915. (Abst.).

The Bauman test for epistasis was used. "In this test the mean of two entities crossed with an inbred tester is compared with the cross of the two entities crossed with the same inbred tester." A series consisting of three double hybrids and two double-double crosses was tested for epistasis with two testers in 1957, while a series comprising six single crosses, six double hybrids and one double-double cross was similarly tested with three testers in 1958. Epistasis was measured for the following ten characters; "per cent bloom on an arbitrary day"; percentage grain moisture; grain yield; percentage of strong stalks at harvest, as determined by the push method; plant height; ear-node height; "per cent ear node height"; and length, diameter and length-diameter ratio of the ear. Measurable epistasis was found in three types of hybrid combinations for all characters and it is therefore concluded that epistasis is of general importance in maize performance. "The effect of tester genotype on the efficiency of detection of non-allelic gene interaction by the Bauman test was confirmed. The theoretically important interactions involving environments with epistatic gene action as a portion of specific combining ability were confirmed.

"The effect of epistasis on testing new hybrids and evaluating inbreds in top cross experiments was discussed. Diverse locations and years were found to be necessary for hybrid evaluation as a result of the commonly found epistasis x environments interactions for all characters in single cross, double cross, and double-double cross hybrids. It was found that the use of wide genetic base hybrids as tester parents in top cross experiments would measure epistatic gene action as well as general combining ability, thus complicating inbred evaluation."

1841 JUGENHEIMER, R. W.
Index to performance records of Illinois experimental double-cross corn hybrids tested during 1946–1959.
Bull. Ill. agric. Exp. Sta. 1960 : No. 662 : Pp. 12.

The number, pedigree and years of test of nearly 1200 Illinois experimental hybrids are tabulated.

1842 STAJKOV, G. & STANČEVA, P.
(**Investigations of some chemical and physiological properties in hybrid maize**).
Nauč. Trud. visš. selskostopan. Inst. V. Kolarov (Sci. Trans. V. Kolarov high. argic. Inst.), Plovdiv 1957–1958 (1959) : **6** : 393–409. [Bulgarian].

Grain of maize hybrids was found to exceed that of one parent and often that of both in starch, crude-protein and crude-fat content. The weight of the hybrid grain approached either that of the mother variety or that of the parent with the higher weight. The developmental rhythm of the hybrids resembled that of the earlier parent. Catalase and peroxidase activity were lowered in the hybrid grain and amylase activity raised. Heterosis was observed in germination, growth and the development of the reproductive organs.

1843 Sprague, E. W., Dhawan, N. L. & House, L. R.
Increased food production with hybrid maize.
Curr. Sci. 1960 : **29** : 295–97.

Considerable progress has been achieved in India since the inception of the Co-ordinated Maize Breeding Scheme in 1957. Out of 5000 inbred lines obtained from all the major maize-growing regions of the world, about 90, mostly from India, the USA and South America, have now been selected for use in the development of hybrids suited to Indian conditions. It is stated that by 1962 a suitable hybrid will be available for each maize-growing area in India.

1844 Stead, B. & Wessels, H. W.
What hybrids should the highveld maize farmer plant ?
Fmg. in S. Afr. 1960 : **36** : No. 7 : 51–52.

Information is given on the yielding capacity, time of maturity and reaction to several diseases of dent and flint hybrids available for the highveld region, Transvaal.

1845 Barrientos, F. & Palacios de la Rosa, G.
Maíces mejorados para la Mesa Central. (**Maize varieties for the central plateau**).
Circ. El Horno 1960 : No. 5 : unpaginated.

The hybrids H–24, H–125, H–126 and H–127 are described.

1846 Shulkcum, E. & Genter, C. F.
Corn performance tests in Virginia in 1958.
Res. Rep. Va. agric. Exp. Sta. 1959 : No. 24 : Pp. 36. (Mimeographed).

A report is given on the performance of hybrids tested in various parts of Virginia during 1958, together with recommendations based on these and previous tests.

1847 Lebedeff, G. A. & Stacy, S. V.
Georgia 102, all purpose yellow corn hybrid for Georgia.
Ga. agric. Res. 1959 : **1** : p. 3.

Georgia 102 [(GE54 x T204) x (NC88 x GE620)] is early in ripening and, on account of its resistance to lodging and the low position of its ears, well adapted to mechanical harvesting.

1848 Riedl, W. A.
Wyoming hybrid corn performance trials, 1955–1958.
Bull. Wyo. agric. Exp. Sta. 1959 : No. 362 : Pp. 15.

Information is provided on the performance of commercial and experimental hybrids tested for two or more years during 1955–58 at five centres in Wyoming.

1849 Smeltzer, D. G.
A search for better field corn varieties by intercrossing.
Calif. Agric. 1960 : **14** : No. 7 : p. 6.

Most of the maize acreage in California is planted with hybrids developed in the Midwest of the USA, but it is unlikely that these represent the highest degree of adaptation of the crop to conditions in the state. In the hope of breeding a better adapted variety, a modification of the system of reciprocal recurrent selection is being applied. The two initial sources of material were respectively produced by intercrossing lines from the locally adapted open-pollinated variety King Philip Hybrid and by intercrossing lines from the Midwest.

1850 Torres, J. P.
Breeding techniques in the production of double cross hybrids.
Philipp. J. Agric. 1956 : **21** : No. 1–4 : 65–75.

With some reference to maize production in the Philippines, methods used in developing inbreds and hybrids are outlined. The Texas type of cytoplasmic male sterility and *Rf* for pollen restoration are to be introduced into Philippine inbreds and single crosses so as to be able to produce the hybrid (I18 x I80) x (A102 x A106) without detasseling.

1851 Stratula, V., Pop, L. & Coifan, M.
Cultura irigată a porumbului dublu hibrid în lunca Jiului. (**Irrigated culture of double hybrid maize in the valley bottom of the Jiu**).
Probl. Agric., București 1960 : **12** : No. 6 : 31–37.

A comparative trial of American, Rumanian and Russian varieties is reported, the highest yield being given by Pioneer 345.

1852 York, J. O., Brown, D. A. & Bryan, B. B.
How do corn hybrids compare when grown at different production levels ?
Arkans. Fm. Res. 1960 : **9** : No. 5 : p. 12.

Maize hybrids which were superior under cultural practices designed for 100 bushel per acre production remained superior when practices suitable for 150-bushel production were employed.

1853 Tverdohleb, N. S.
(Replacing the hybrid VIR 42 in production by its parental form Slava).
Kukuruza (Maize) 1959 : No. 8 : 43–45. [Russian].

The single cross Slava [Glory] (VIR 44 [Institute of Plant Industry 44] x VIR 38) has persistently outyielded the double cross VIR 42 (Slava x Svetoč [Torch] on farms in the Gul'kevič district of Krasnodar. The question is asked whether the production of VIR 42 should be discontinued and a larger acreage sown with Slava. The production of the single cross can be made more economical by using the male-sterile line of VIR 44 which has been bred at the Institute of Plant Industry.

1854 Galeev, G. S.
(The suggestion by comrade Tverdohleb is premature).
Kukuruza (Maize) 1959 : No. 8 : 46–47. [Russian].

In reply to Tverdohleb [cf. **1853**], Galeev states that the higher yields reported for the single cross Slava [Glory] compared with the double cross VIR 42 [Institute of Plant Industry 42] probably resulted from differences in soil and moisture in the field and from inadequate detasseling which would result in a greater reduction in the yield of the double cross than its parental form.

Also the production of double crosses is said to be more economical than that of single crosses, at any rate until more productive inbred lines than the components of Slava become available.

1855 Aala, F. T.
Some notes on the development of male sterile lines in seed corn.
Philipp. J. Agric. 1956 : **21** : No. 1–4 : 103–09.

The procedure for producing hybrid seed without detasseling, by exploiting cytoplasmic male sterility and pollen-restoring genes, is described. The potential value of the method for the Philippines is discussed.

1856 Vittal Rao, S.
The prospects of flint x dent hybrids in maize.
Curr. Sci. 1960 : **29** : p. 454.

At the Regional Maize Breeding Station, Hyderabad, the flint x dent hybrid (WF9 x 38–11) x (KL1 x KL3) has consistently outyielded the hybrid Texas 26 and in addition has the hard grain character desired by Indian farmers.

1857 Gorsline, G. W.
A graphical "regression selection" technique for maturity-related characters in field corn.
Agron. J. 1960 : **52** : 581–84.

The application of the above technique to evaluate hybrids of maize for grain yield in relation to measurements of maturity is described. It was demonstrated that superior early hybrids which would be discarded unjustifiably by ordinary evaluation on the basis of yield only were readily distinguishable. Procedures to use with significant hybrid x environment interactions are discussed. A graph is given illustrating the anomalies between the two criteria of maturity used, viz. number of days from sowing to mid-silk stage and grain moisture at harvest, and the choice of the appropriate measurement of maturity to use in the regression technique is considered. It is concluded that the technique is likely to give more satisfactory results in evaluating hybrids for yield and other characters related to maturity yield than tests in which maturity is not fully considered.

1858 **Two new corn hybrids resistant to leaf blights announced for Indiana.**
Crops & Soils 1960 : **13** : No. 2 : p. 18.

Two further leaf-blight resistant hybrids, Ind. 872 and Ind. 828, in addition to Ind. 851, Ind. 873 and Ind. 874, have been developed. All five are double hybrids, which yield well in the presence or absence of leaf blights.

1859 Brink, R. A., Brown, D. F., Kermicle, J. & Weyers, W. H.
Locus dependence of the paramutant R phenotype in maize.
Genetics 1960 : **45** : 1297–1312.

Paramutant phenotypes $R^{r:st}$, $R^{r:lst}$ and $R^{r:mb}$ respectively conditioning stippled, light stippled or marbled aleurone [cf. XXVIII, 4150], are here designated $R^{r'}$; this paper is concerned mainly with crosses involving R^{st} but similar results are reported when R^{mb} was substituted as the paramutagenic allele.

Direct demonstration of *R*-locus dependence of the paramutant phenotype $R^{r'}$ was possible using a series of R^{g} mutants obtained from standard R^{r} which they resembled in aleurone pigmentation capacity and in paramutability in heterozygotes with R^{st}, but which they differed from in producing green instead of red seedlings. $R^{r'}R^{g}$ and $R^{r}R^{g'}$ plants were obtained and test crossed to $r^g r^g$ ♀. Kernels were scored for colour before classifying definitively on seedling colour. Paramutant phenotypes were always associated with alleles of heterozygous origin, and darkly pigmented phenotypes with alleles from a stock culture. When $R^{r'} R^r$ plants from the mating $R^r R^{st}$ x $R^r R^r$ were test crossed, a bimodal distribution of aleurone phenotypes resulted, in agreement with the expectation on the basis of *R*-locus dependence of paramutation.

1860 Graner, E. A. & Ferraz de Toledo, F.
Milho: estudo comparativo entre variedades, híbridos, sintéticos e híbridos de sintéticos. (**Maize: a comparative study of varieties, hybrids, synthetics and hybrids between synthetics**).
Rev. Agric., Piracicaba 1959 : **34** : 51–65.

A detailed comparison of the performance of 3 varieties, 1 hybrid, 4 synthetics and 5 hybrids between synthetics was made at the Luiz de Queiroz School of Agriculture, Piracicaba. Statistical differences in plant height and grain yield but not in ear height or husk and cob percentages were obtained. The highest yields were given by the synthetic hybrids (1) Mexican synthetic x Santa Rosa–Campinas synthetic and (2) Mexican synthetic x Santa Rosa synthetic.

1861 Lebedeva, Z. V.
(The production of maize inbreds with foreign pollen participating in fertilization).
Agrobiologija (Agrobiology) 1959 : No. 4 : 540–44. [Russian].

The substance of the report is contained in a paper which has been already summarized [XXIX, 2601].

1862 Coe, E. H.
The pattern of origination of conversion-type inheritance at the *B* locus in maize.
Genetics 1960 : **45** : 981–82. (Abst.).

The initial change from orthodox to conversion-type inheritance of plant colour occurs as a random event with varying probability. *B'* individuals appear in unstable *BB* lines at frequencies ranging between 0% in progenies as large as 167 and 100% in progenies as large as 45. The instability appears to be transmitted to progenies in either the same or a more intense degree. Ear maps show that *B'* does not occur in sectors but arises in separate kernels as a consequence of random independent events. The mutational event may thus be placed in time between the initiation of ovule primordia and germination. If, as seems most likely, the event is restricted to meiosis, it would appear to be chromosomal or genic. [Cf. XXIX, 3812].

1863 Kiesselbach, T. A.
The significance of xenia effects on the kernel weight of corn.
Res. Bull. Neb. agric. Exp. Sta. 1960 : No. 191 : Pp. 30.

Xenia effects on kernel weight of mature maize are due to one or more of three causes, namely (1) a change in hybrid vigour of the non-maternal tissues, which may be related to the action of either chromosomal dosage or specific genes; (2) a change from recessive to dominant endosperm type with its accompanying physiological effects; and (3) quantitative inheritance. Studies illustrating these effects are reported and discussed with reference to data obtained in previous investigations. It was noted that "xenia effects involving change of primary-endosperm type bring about materially increased yield of grain per plant and per acre, whereas mere changes in the hybrid vigor of kernels may or may not have such yield effects. The acre-yield of sweet corn was increased by an average of 27·2 per cent during three years as a xenia effect of out-crossing by dent. Likewise, waxy corn responded with a 3·3 per cent increase in grain yield."

It is shown that in the absence of specific genes which decrease translocation to the grain, increased hybrid vigour of the kernels, caused by xenia, tends to increase the kernel weight and the yield of grain per plant and per acre, provided the supply of solutes within the stalk is sufficient to support additional growth of the kernel. The amount of such reserves appears to be influenced both by the suitability of environmental growth conditions and the xenia effects on rate and duration of translocation to the kernel during its active development.

"It is concluded that at least some lines and F_1 hybrids may respond with higher yields of grain per acre and others with lower yields when outcrossed in varietal tests than when sib-pollinated as in commercial production-fields. Data reported clearly indicate that hybrid vigor of an F_1 progeny is not related to initial difference in size of seed planted. They are interpreted in support of the theory that hybrid vigor is related to both the number and the importance of specific, dominant growth genes. The effect is additive, and it is immaterial whether the homologous gene-pairs in the sporophytic tissues are homozygous or heterozygous."

1864 Nickerson, N. H.
Sustained treatment with gibberellic acid of maize plants carrying one of the dominant genes teopod and corn-grass.
Amer. J. Bot. 1960 : **47** : 809–15.

It was possible to reduce the expression of *Tp* (teopod) and *Cg* (corn grass) by appropriate treatment with gibberellic acid so that plants containing either of them became essentially normal in appearance. The possible nature of the effect of gibberellic acid in modifying the expression of specific genes in maize is briefly considered.

1865 Brink, R. A.
Paramutation and chromosome organization.
Quart. Rev. Biol. 1960 : **35** : 120–37.

A detailed survey is given of paramutation at locus *R* in maize [cf. XXIX, 3368, XXXI, 1859 and 1866–7]. Phenomena in other plants and in *Drosophila* which are interpretable as paramutation are also considered. Information on mutable loci and paramutation in maize is then discussed in terms of a model of chromosome organization in which it is assumed that the chromosome comprises two substances, orthochromatin and parachromatin. Orthochromatin is the genetic substance proper, varying by mutation. Parachromatin is self replicating, coextensive with orthochromatin, and finally dependent for continuity on a special class of gametically transmissible determinants which, like orthochromatin, are defined by DNA nucleotide sequences. Parachromatin conditions the intrachromosomal processes underlying the functional differentiation of loci by undergoing paramutation in somatic cells, in an orderly way, in response to the changing cellular environments of the developing organism. The substance may be regarded as being relatively homogeneous, although not homologous, throughout the genome, in accordance with its general function of activating the orthochromatin. Whereas orthochromatin remains qualitatively constant in all nuclei of the individual, parachromatin is altered by "accretion, diminution and in other ways," in accordance with the cellular substrates produced during ontogeny. Parachromatin thus takes on a succession of potentially reversible, but mitotically transmissible states. Since parachromatin effects "communication" between the orthochromatin and nuclear metabolic pool, its ultimate role is epigenetic. The behaviour of paramutable *R* alleles and the data on mutable loci in maize may be explained in terms of paramutation in the parachromatin, provided an additional assumption is made, viz. that these phenomena reflect paramutations which are somatically irreparable and therefore simulate mutations in that they are germinably transmissible.

1866 Brown, D. F. & Brink, R. A.
Paramutagenic action of paramutant R^{r} and R^{g} alleles in maize.
Genetics 1960 : **45** : 1313–16.

The paramutant alleles $R^{r\prime}$ and $R^{g\prime}$ derived from heterozygotes containing R^{st} are themselves paramutagenic [cf. 1859]. Relative to R^{st}, however, they are only weakly paramutagenic.

1867 Brink, R. A. & Weyers, W. H.
Effect of an abnormal knob-carrying chromosome 10 on paramutation of R^{r} in maize.
Genetics 1960 : **45** : 1445–55.

R^{r} is known to be highly paramutable in heterozygotes with R^{st} (stippled aleurone) or R^{mb} (marbled aleurone) [cf. XXIX, 3368]. R^{r} has however been found to be relatively insensitive to paramutation when incorporated into an abnormal chromosome 10 (K10) possessing a large heterochromatic knob. As expected, paramutation, which is a somatic phenomenon, was not influenced by the meiotic irregularities caused by K10. R^{r}, on being returned to a normal chromosome from K10 by crossing over, proved to be, in the single case tested, again relatively sensitive to paramutation in heterozygotes with R^{mb}.

1868 Weyers, W. H.
The paramutagenic action of the marbled allele in maize.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1028 : p. 3932. (Abst.).

Investigations on R^{mb} (marbled aleurone, green seedling) and its paramutagenic action are reported [cf. XXIX, 3388]. R^{g} (coloured aleurone, green seedling) proved to be similar to R^{r} (coloured aleurone, red seedling) in paramutability in heterozygotes with R^{mb}. Selection of the test-cross progeny of a single $R^{r}R^{mb}$ plant crossed with $r^{r}r^{r}$ resulted in the isolation of $R^{r \cdot mb}$ paramutants differing in pigment-producing capacity. Selection within inbred W22, into which the character of marbling had been introduced, yielded R^{mb} sublines differing in paramutagenic competence. The capacity of R^{mb} to alter R^{r} could be reduced by first passing R^{mb} through a heterozygote with R^{st}

(stippled aleurone, green seedling). Five independent self-coloured mutants from R^{mb}, however, retained the paramutagenicity of the parent R^{mb} allele. As reported elsewhere [cf. 1867], paramutability of R^{r} in heterozygotes with R^{mb} was greatly reduced when R^{r} was inserted into a chromosome with a large terminal heterochromatic knob. Attempts to change the amount of aleurone spotting in R^{mb} plants by selection resulted in the isolation of families differing not only in grade of marbling but also rate of mutation to self colour. Marbled sublines exhibiting extensive aleurone pigmentation showed high frequencies of germinally transmissible mutations to self colour. The differences between sublines in aleurone spotting persisted in recurrent matings with W22 $r^{\mathrm{r}}r^{\mathrm{r}}$ (colourless aleurone, red seedling). In a light-marbled family tested with $r^{\mathrm{r}}r^{\mathrm{r}}$, the mutation rates to self colour in homozygotes and heterozygotes were respectively, 0·0 per 10^4 and 6·8 per 10^4 gametes. Two marbled W22 sublines differing in degree of aleurone spotting and rate of mutation to self colour were indistinguishable in paramutagenicity.

1869 SCHWARTZ, D.
Analysis of a highly mutable gene in maize. A molecular model for gene instability.
Genetics 1960 : **45** : 1141–52.

As already reported, c^{m} at locus C, for anthocyanin pigmentation in the aleurone, undergoes cyclic changes in mutability, alternating between stability and instability [cf. XXX, 359]. A molecular model for the instability of this allele is presented, which is based on illegitimate base-pair configurations in DNA according to the modification of the Watson-Crick model proposed earlier by the author [cf. XXVIIII, 3752].

1870 BIANCHI, A., MARIANI, G. & UBERTI, P.
Endosperm and seedling mutations induced in maize, following X-irradiation and diepoxybutane treatment of mature pollen.
Genetics 1960 : **45** : p. 976. (Abst.).

Homozygotes for $a_1\ sh_2\ lg_1\ pr$ were fertilized with $A_1\ Sh_2\ Lg_1\ Pr$ pollen treated with (1) diepoxybutane, (2) diepoxybutane and 1–2 kr. of X rays and (3) 1–2 kr. Diepoxybutane was effective as an inducer of mutant endosperm sectors but its effect in the F_1 was negligible. An interaction may possibly occur between the action of the chemical and the X-ray dose. "*Pr* is lost about one third less frequently than A_1Sh_2 (the last two being, usually, lost together); the frequency at which they are lost is an exponential function of X-ray dose; the sector losses, however, in the material X-rayed only, increase almost linearly with the dose; the material treated with diepoxybutane and X-rays does not show concomitant variations for sectorial losses at the various X-ray doses". The frequency of "germless" was exponentially related to X-ray dose, while induction of the remaining dominant lethals appeared as an almost linear function of the dose. The frequency of dominant lethals in $a_1\ sh_2$ kernels was at least twice as high as in $A_1\ Sh_2 + Pr$ kernels.

1871 KÜHN, F.
Poznání našich povolených odrůd kukuřice podle zrna. (**Recognizing our approved varieties of maize from the grain**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1235–46.

Illustrations and a key are provided for identifying with the naked eye the grain of maize varieties officially approved in Czechoslovakia in 1958 and 1959.

1872 JUDIN, B. F.
(**Some biological characteristics of maize in the central Urals**).
Kukuruza (Maize) 1959 : No. 8 : 48–51. [Russian].

Differences in growth period, tolerance of low temperatures and resistance to insects and diseases of a few varieties from the collection of the Institute of Plant Industry at Sverdlovsk are described. Goudster [Golden Star], originating from Holland, and Małopolanka, from Poland, are regarded as particularly well adapted to the central Urals, as they are mid-season types with a quick initial rate of growth in the spring when the soil and air temperatures are still low. Transcarpathian 89, Osetinskaja Belaja Zubovidnaja [Osetian White Dent] and the hybrids Kollektivnyj [Collective], (17 x 18) x Voronež 76 and (27 x 26) x Voronež 76 showed a high degree of resistance to *Oscinella*; all these are highly productive forms with a quick initial growth rate.

1873 KOSTOVA, R. & PAVLOV, P.
(**Study of some local maizes in north-western Bulgaria**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **8** : 271–87. [Bulgarian].

Eighteen varieties have been studied, and the six best are described in detail. All are intermediate between the dent and flint types, are medium in height, leafiness and vegetative period, tend to produce ears with thick cobs, and show satisfactory drought resistance and good adaptation to the area.

1874 RANDOLPH, L. F.
The origin of maize.
Indian J. Genet. 1959 : **19** : 1–12.

Studies on the relationship between maize, teosinte and *Tripsacum* are reviewed and an assessment is made of various theories on the origin of cultivated maize. The author's own views are presented [cf. XXV, p. 271 and XXVII, p. 164].

1875 MORENO MOSCOSO, U.
Estudio del número de cromosomas tipo "B" y de la frecuencia y posición de nudos cromosómicos en razas de maíz del Perú. (**A study of the number of B chromosomes and the frequency and position of chromosome knobs in the races of maize in Peru**).
Agronomía, Lima 1960 : **27** : 39–51.

A study of 30 maize races, occurring in the coast, mountain and forest regions of Peru, has indicated that only five races, all from the coastal area, possess a relatively high number of chromosome knobs, i.e. between 6 and 14. All the other races have either none or very few knobs, and it is suggested that these few have been acquired by introgression with North American races.

B chromosomes were found to be most frequent in the mountain races. On the basis of the data, the Peruvian races are divided into the following four categories: (1) coastal races with a high number of knobs but without B chromosomes; (2) coastal races with a small number of both knobs and B chromosomes; (3) mountain races with only few knobs and many B chromosomes; and (4) two forest races, Chuncho with many knobs and Piricinco with few knobs, both having few B chromsomes. It is contended that the data confirm that most Peruvian maize races have not suffered introgression and are peculiar to the region.

1876 TABATA, M.
Studies of chromosome pairing in maize by using interchanges involving the same two chromosomes.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–950 : 3930–31. (Abst.).

Use was made of interchanges between chromosomes 2 and 6, 3 and 6, and 6 and 9. Of the 17 intercrosses studied, 4 belonged to type 1a (breaks in both chromosomes in opposite arms), eight to type 1b (breaks in one chromosome in opposite arms and in the same arm in the other chromosome), and five to group 2 (breaks in both chromosomes in the same arm). At pachytene in type-1a and group-2 intercrosses, the chromosome ends usually underwent complete homologous pairing whether in "pairs" or in an association of four chromosomes. Intercalary segments showed extensive nonhomologous association or asynapsis. In type 1b intercrosses, the ends were also associated in ⊙4 configurations. In none of these intercrosses did the centromeres play a significant role in pairing. Pairing in maize therefore usually begins at the chromosome ends. In certain intercrosses the frequent failure of pairing in the short terminal segment or satellite translocated to other chromosomes was correlated with complete pairing in the adjacent intercalary regions, the importance of the ends in controlling the behaviour of other regions thus being indicated. The results of genetic-linkage tests and spore-quartet analyses were in good agreement with the behaviour of the chromosomes at pachytene. Difficulty encountered by homologous pairing because of nonhomologous pairing or asynapsis was reflected in reduced or no detectable crossing over. The high frequencies of "pairs" in type-1a and group-2 intercrosses at diacinesis may be attributed to the preferential pairing of homologous ends over intercalary segments. In type-1a intercrosses, a viable set of chromosomes with new combinations of the chromosome segments may be derived from the simultaneous occurrence of crossing over in the two "between breaks" segments in the complex of four chromosomes. In such a set, consisting of otherwise normal chromosomes, the centromere-bearing "between breaks" segment of one chromosome would have been exchanged with that of the other chromosome.

1877 MAGUIRE, M. P.
Relative positions of chromosomes at pachytene in diploid and hyperploid stocks.
Genetics 1960 : **45** : p. 999. (Abst.).

To explore the question whether synapsis is initiated by the random meeting of moving chromosomes or by a specific force of attraction, investigations were carried out on the relative positions of chromosomes at pachytene in maize, bearing in mind that these positions might still reflect affinities of the earlier stage of pairing. The stocks studied were: (1) maize hyperploid for a *Zea-Tripsacum* interchange chromosome, the distal half of the short arm of chromosome 2 of maize being present in triplicate; (2) a stock heterozygous for a *Tripsacum* segment and hyperploid for the interchange chromosome, the distal half of the short arm of chromosome 2 being carried in duplicate but with one of its representatives in the extra interchange chromosome; (3) maize homozygous for the *Tripsacum* segment and hyperploid for the interchange chromosome, the distal half of the short arm of chromosome 2 thus being present only singly, in the extra chromosome; (4) a normal $2x$ stock. The linear centre of each chromosome was used as a convenient index of its location, no special attributes being attributed to this point. Acetocarmine smear preparations of PMCs were studied with the assumption that changes in positions of chromosomes during slide preparation were random and did not affect individual chromosomes selectively. Chromosomes univalent at pachytene were relatively near to bivalents carrying segments homologous to them, with significant frequencies. The results are not easily reconciled with the hypothesis that synapsis is initiated by random movements.

1878 Swomley, B. A.
Analysis of intercrosses between non-homologous translocations involving chromosomes 2 and 4 in maize.
Diss. Abstr. 1960 : **21** : LC Card Mic 60–2247 : 19–20. (Abst.).

A report is given of genetical and cytological analysis of duplication and deficiency in the pollen of derivatives of intercrosses of the above type.

1879 Lenkov, L. D. & Dimova, R. T.
(A study of flowering in some maize varieties).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **8** : 187–213. [Bulgarian].

Varietal differences in time and duration of silking, tasseling and pollination in five varieties grown in Bulgaria are given. Data on duration of pollen viability are included.

1880 Bianchi, A.
The surface of the leaf in normal and glossy seedlings.
Genetics 1960 : **45** : p. 976. (Abst.).

By electron microscopy it was possible to resolve the fine structure of the leaf surface of *Gl* maize seedlings as compared with seedlings homozygous for gl_1, gl_2, gl_3 and gl^H. The surface of the normal leaf showed minute projections from the cuticle, which were almost absent or only very minute in young glossy seedlings. When leaves of the normal type were washed in xylene, the surface was very similar in appearance to that of the surface in untreated *gl* seedlings.

1881 Ustinova, E. I.
(Cytoembryological investigations of the embryo sac and the fertilization process in maize).
Ž. obšč. Biol. (J. gen. Biol.), Moskva 1960 : **21** : 261–69. [Russian].

In studies at Moscow the embryo sacs were found to develop at different times, depending on the position of the florets in the ear. Fertilization was intensified by pollination with pollen mixtures or with a large amount of pollen and the embryo developed more quickly. Many pollen tubes were observed to reach the embryo sac when a large amount of pollen or pollen mixtures were used.

1882 Stead, B.
The gene action involved in the fertility restoration of Texas type cytoplasmic male sterile maize and its performance compared with normal cytoplasm.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1509 : 4250–51. (Abst.).

Crosses involving (1) seven pollen-restorer inbreds, (2) three partial-restorer inbreds, (3) six male-sterile inbreds with the Texas type of cytoplasmic sterility and (4) the normal counterparts of (3) were investigated. Only a single gene controlled restoration of complete fertility by (1), the genes in the seven lines being non-allelic. Two complementary genes, greatly influenced by modifiers, were responsible for partial restoration of fertility by (2). Three of the male-sterile lines were homozygous for one of these complementary genes, whereas the other three required both partial-restorer genes to produce viable pollen. In comparison with normal cytoplasm, the presence of the Texas type of cytoplasm in crosses did not have any consistent effect upon yield, moisture content at harvest and other characters. Four to six back crosses to the normal parent were apparently insufficient to produce a male-sterile line isogenic with its normal counterpart.

1883 Zuber, M. S., Deatherage, W. L., Grogan, C. O. & MacMasters, M. M.
Chemical composition of kernel fractions of corn samples varying in amylose content.
Agron. J. 1960 : **52** : 572–75.

Analysis of samples ranging in amylose content from 21–30% to 71–80% showed that amylose percentage was negatively correlated with endosperm weight and starch percentage and positively correlated with pericarp weight, germ weight and the protein and oil percentages of the endosperm. Data obtained on associations between kernel components other than amylose content are also discussed.

1884 Thompson, D. L. & Rawlings, J. O.
Evaluation of four testers of different ear heights of corn.
Agron. J. 1960 : **52** : 617–20.

A detailed analysis was made of crosses of 26 "low normal" inbreds with 4 single-cross testers which had different ear heights and were classified as (1) dwarf, (2) low normal, (3) medium tall and (4) tall. Low normal lines bore their ears at considerably lower heights than normal inbreds but did not exhibit the shortened internodes characteristic of the brachytic dwarf type (br_2). Ear height of the inbreds was correlated with ear height of the tester crosses; the correlations were significant at the 1% level and ranged from 0·54 for tester 4 to 0·75 for tester 2. Correlations between testers, as calculated from the tester crosses, varied from 0·65 to 0·87 for ear height and from 0·63 to 0·84 for yield, all correlations being significant at the 1% level. Variance analysis revealed significant tester x inbred interactions for both ear height and yield. The components of variance for ear height among inbreds were 9·63, 7·94, 11·24 and 10·44 for testers 1, 2, 3 and 4 respectively. Corresponding estimates for yield were 29·28, 53·81, 37·98 and 53·02. Testers 2 and 4, which had the lowest yields, had the highest components of variance for yield. It was concluded that all four testers were almost equally effective for evaluating inbreds for ear height or yield, although the tester with the lowest yields had a slight advantage for assessing yield potential. A notable feature of the results was the finding that crosses of the low normal inbreds with dwarf tester 1 bore ears in a comparatively low position and were nearly satisfactory in yield. This pointed to the possibility of producing low-eared double crosses by combining dwarf and low normal single crosses and also suggested that the positive and significant association generally observed between ear height and yield is not necessarily a serious difficulty in breeding.

1885 Torje, D., Munteanu, O., Tutoveanu, A. & Oproiu, D.
Compoziţia chimică a soiurilor şi hibrizilor de porumb cultivaţi în R.P.R. **(Chemical composition of the varieties and hybrids of maize cultivated in the Rumanian People's Republic).**
Probl. Agric., Bucureşti 1960 : **12** : No. 7 : 16–22.

Data are provided on the protein, starch and fat content of the grains of the principal varieties, intervarietal hybrids and double interline hybrids grown in Rumania.

1886 Nehring, K.
Über Probleme der Einsäuerung von Mais. **(Problems of maize ensilage).**
Wiss. Z. Univ. Rostock : Math.-Naturwiss. Reihe 1957/58 : **7** : 635–44.

Characters affecting capacity for ensilage and the quality of the resulting silage were investigated in a series of varieties. Early ripening accompanied by certain changes in the chemical composition of the grain determines suitability for ensilage.

1887 Messiaen, C. M., Lafon, R. & Molot, P.
Nécroses de racines, pourritures de tiges et verse parasitaire du mais. **(Root necroses, stem rotting and lodging due to parasites in maize).**
Ann. Inst. nat. Rech. agron., Paris : Sér. C. 1959 : **10** : 441–74.

A study of maize reactions to attack by a complex of fungi showed a high correlation between resistance to invasion and sugar content of the stalks.

1888 Johnson, L. F.
***Pythium* root rot—an important disease of corn.**
Tenn. Fm. Home Sci. 1959 : No. **32** : 4–5.

Sixteen commercial maize varieties were evaluated for resistance to *Pythium* under greenhouse conditions. Three varieties, Tennessee 90, Dixie 29 and Funk G–779N, were highly resistant while Dixie 33 and Funk G–711 showed moderate resistance.

1889 Wernham, C. C.
Maize synthetics for disease resistance.
Plant Dis. Reptr. 1960 : **44** : 498–500.

Four new synthetics resistant to leaf blights are described. The synthetic varieties Early, Intermediate and Late were used as pollen parents in crosses with Early Butler, College White Cap, early and late strains of West Branch Sweepstakes and selections from Kautz Flint and Switzgable yellow dent maize. Progeny plants resembling late Sweepstakes were selected for ear size and height and for resistance to lodging, smut and stalk and ear rots; seeds from the best selections were bulked and designated Sweepstakes Synthetic. Early-maturing S_2 lines from the same group of varieties but excluding the late Sweepstakes material were bulked and named Early Synthetic 2.

Leaf-blight resistant plants selected from crosses of inbred lines with material of African origin were further selected for resistance to smut and lodging. Two sets of seed were obtained, one designated South African-American Synthetic OP3, the other South African-American Synthetic : Stiff-Stalked selection.

1890 SZENDE, K.
An unusual mutation frequency to pentose utilization in a strain of *Ustilago maydis*.
Acta biol., Budapest 1960 : **10** : 245–56.

When plated on d-xylose agar, cells of *U. maydis* grown on a glucose medium produced, after lag phases varying between 3 and 18 days, colonies adapted to d-xylose utilization. The ability to utilize d-xylose became stable after one subculture on d-xylose and appears to result from mutation during the residual growth occurring on transference to the d-xylose medium. A modification of the Luria and Delbrück test showed the rate of mutation to be 10^{-3}. Similar lag-phase heterogeneity occurred on d-xylose after preculture on l-arabinose. Xylose-isomerase activity occurred in cultures adapted to d-xylose utilization but not in those deadapted by subculture in glucose; this indicates that d-xylose is necessary as an inducer for the expression of the utilizing phenotype.

1891 WISER, W. J., KRAMER, H. H. & ULLSTRUP, A. J.
Evaluating inbred lines of corn for resistance to *Diplodia* ear rot.
Agron. J. 1960 : **52** : 624–26.

Six dent inbreds and their F_1, F_2 and back-cross progenies were studied for resistance to *D. zeae* when artificially inoculated. The behaviour of the inbreds was inadequate for determining their relative resistance because of lack of vigour, poor seed set and attack of the ears by other fungi. Estimates of infection for inbreds based upon the averages of all back crosses having the same recurrent parent provided a good indication of relative resistance. With the exception of crosses involving inbreds R4 and Ill. 90, F_2 and back-cross means for each cross agreed closely with the expected mid-parental value. Mean percentages of infection in back crosses to the resistant parent regressed towards the reaction of the resistant parent, while those for both the F_1 and back crosses to the susceptible parent regressed towards the reaction of the susceptible parent. Ill. 90 and R4 were essentially alike in response to the pathogen but differed widely in ability to transmit their reaction. Use of average F_1 data may not therefore be valid as an indirect method of evaluating inbreds for disease resistance.

1892 KINGSLAND, G. C. & WERNHAM, C. C.
Variation in maize seedling blight symptoms with changes in pathogen species, isolate and host genotype.
Plant Dis. Reptr. 1960 : **44** : 496–97.

Hybrids Pa.602A [(Ind.WF9 x Oh.51A) x Pa.54 x Wis.22)] and Pa.775 [(Ind.WF9 x Pa.86) x (Oh.43 x Pa.70)] and inbreds Pa.70 and Wis.23 were all susceptible to *Gibberella zeae* isolate 1614. Isolate 1610 however caused complete blighting of the inbreds but not of the hybrids. Five isolates of *Fusarium moniliforme* and six of *F. moniliforme* var. *subglutinans* all failed to cause seedling blight when tested on the same material.

1893 KALASHNIKOV [KALAŠNIKOV], K. E. & SHAPIRO [ŠAPIRO], I. D.
Control measures against pests and diseases in corn crops.
IX International Conference on Quarantine and Plant Protection against Pests and Diseases 1958 : Pp. 14.

A programme for the selection of maize varieties resistant to wireworm has been undertaken in the Soviet Union. A number of hybrids partially resistant to *Ustilago zeae*, including VIR25, VIR42 and Iskra [Spark], are now in cultivation.

1894 SHAPIRO [ŠAPIRO], I. D.
Some new aspects of the frit fly biology conditioned by the advance of the corn to northern regions.
IX International Conference on Quarantine and Plant Protection against Pests and Diseases. 1958 : Pp. 10.

Late-maturing maize varieties, characterized by rapid formation and growth, display higher resistance to *Oscinella frit* than do early-maturing varieties, in which tassel differentiation prevails over leaf growth. In a 1956 Russian study, the average number of larvae on the late variety Odessa 10 was three times lower than on the early variety Kičkasskaja. In a trial comprising 500 hybrid and inbred varieties grown in the Leningrad region, the highest resistance was found in varieties bred in the Netherlands, notably Srednespelaja N 29 [Midseason N 29].

1895 Csou, J.-Cs. [Chou, Y.-C.]
Kukoricamoly (*Pyrausta nubilalis* Hbn.) ellenállósági vizsgálatok magyar és kínai kukoricafajtákon. [**Studies on the resistance of Hungarian and Chinese maize varieties to European corn borer (*P. nubilalis* Hbn.).**
Növénytermelés 1960 : **9** : 141–52.

Clear differences in susceptibility were detected among five artificially infected Hungarian lines and hybrids. Field studies of 12 Hungarian and eight Chinese varieties in three localities in Hungary showed however that environmental differences were greater than varietal. The total number of infected internodes has proved a useful criterion of resistance. The Hungarian hybrid Martonvásár 5 and a Chinese variety referred to as Jung-li-ce are regarded as the most suitable material on which to base further breeding for resistance.

1896 Chiang, H. C. & Holdaway, F. G.
Relative effectiveness of resistance of field corn to the European corn borer, *Pyrausta nubilalis*, in crop protection and in population control.
J. econ. Ent. 1960 : **53** : 918–24.

Investigations were carried out on the survival and development of *P. nubilalis* on five resistant and five susceptible double hybrids in southern Minnesota in 1956, 1957 and 1958. Infested plants remaining after dissections in the summer and autumn were not harvested or otherwise disturbed throughout the winter. The following conclusions were reached. (1) Average survival and average rate of development of the first-brood borers were lower on the resistant hybrids than on the susceptible. (2) The reactions of each individual hybrid, however, varied from year to year. (3) In both susceptible and resistant hybrids, the larvae suffered a mortality of nearly 60% during the first 2 hours and nearly 80% during the first 24 hr. of their life on the plant; possibly this initial mortality was not therefore caused by host reactions. It is accordingly suggested that mortality due to plant resistance should be estimated on the basis of the population escaping the initial indiscriminate mortality. (4) The numbers of borers found in the following spring, i.e. beginning of the next annual cycle, were almost identical on both resistant and susceptible hybrids. This elimination of the differential found for the first brood was brought about by (*a*) increase in number of borers in the autumn as a result of higher second-brood infestation of plants which had been resistant to the first brood and had had low first-brood infestation, and (*b*) a lower overwintering mortality on the resistant than on the susceptible hybrids. (5) Infection by the protozoan parasite *Perezia pyraustae* was lower among borers on resistant varieties than those on the susceptible entries. This difference could have been responsible for the higher overwintering survival of borers on the resistant hybrids.

1897 Dubrovina, V. A.
(The length of the light phase in some maize varieties).
Agrobiologija (Agrobiology) 1959 : No. 4 : 628–30. [Russian].

In photoperiodic studies at Odessa, some varieties and hybrids were first given 10 hr. days, required by the plants to complete the light phase, and then 24 hr. days. If the duration of the 10 hr. treatment was too short the earing of the plants was retarded. The number of 10 hr. days required by Odessa 1 and Odessa Gruševka was 30; the corresponding number for Dnepropetrovsk was 35 and for the single crosses Svetoč [Torch] and Slava [Glory] and the double cross VIR 42 [Institute of Plant Industry 42], 40.

BARLEY

1898 Klingmüller, W.
Zur Frage einer jahresperiodischen Änderung der Strahlenempfindlichkeit bei Gerste. (**The question of seasonal change in sensitivity to radiation in barley).**
Naturwissenschaften 1960 : **47** : 261–62.

Seasonal variation in sensitivity to X irradiation is thought to be caused by changes in the water content of the grain.

1899 Chery, J.
La culture et l'amélioration de l'orge. (**The cultivation and improvement of barley).**
Progr. agric. vitic. 1960 : **77** : 130–38, 169–75, 234–38.

The performance of standard barley varieties in various regions of France is discussed, and some of the possibilities for future improvement of the crop are outlined.

1900 Guitard, A. A.
The use of diallel correlations for determining the relative locational performance of varieties of barley.
Canad. J. Pl. Sci. 1960 : **40** : 645–51.

"Using diallel correlation coefficients based on the yield of nine varieties of barley, eight of the ten test locations in the Upper Peace River region can be arranged into three completely inter-related response groups. Each group has one location in common with the adjoining group. The locational associations for height, bushel weight and 1000-kernel weight are not as consistent but, with a few exceptions, approximate those established for yield. The groupings suggest that the number of barley test locations in the region could be reduced from ten to five without an appreciable loss of information." [Author's summary].

1901 KAUFMANN, M. L. & MCFADDEN, A. D.
The competitive interaction between barley plants grown from large and small seeds.
Canad. J. Pl. Sci. 1960 : **40** : 623–29.

"The competitive effect on yield of plants grown from large and small seeds was demonstrated in both greenhouse and field tests. Plants from small seeds yielded approximately 77 per cent of those grown from large seeds in the greenhouse and 57 per cent in the field with inter-plant competition; with inter-row competition the percentages were 70 and 54 respectively; and, with no competition, 89 and 83 per cent respectively. It was further shown that increased competition favoured plants from large seeds. Superior production resulted mainly from a greater number of heads on plants grown from large seeds.

"Suggestions are made as to how problems arising from this source of non-genetic variation could be overcome in various stages of selection." [Cf. XXX, 17]. [Authors' summary].

1902 ONO, H. & SHIGENAGA, S.
Studies on the morphogenetic action of the gene, I. Responses of the coleoptile of a barley mutant to IAA.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 63–67.

A comparative study of the effect of indole-3-acetic acid (IAA) on young coleoptiles of normal barley and an F_2 population involving a rapidly elongating mutant [cf. XXIX, 2639] is reported. IAA accelerated coleoptile growth in normal barley and to a lesser degree in the F_2 population. Assuming that $\frac{1}{4}$ of the F_2 population was the mutant type, it was inferred that IAA depressed growth in the latter.

1903 WETTSTEIN, D.
Multiple allelism in induced chlorophyll mutants of barley.
Hereditas, Lund 1960 : **46** : 767–72.

Evidence showing the induced mutants *xantha–12, xantha–15* and *xantha–18* to be allelic is reported [cf. 1904]. These mutants are non-allelic to *xa–10, xa–11, xa–13, xa–14, xa–19* and *xa–20*, which all appear to represent different loci. Phenotypically, *xa–12, xa–15* and *xa–18* are variable, their colour depending on temperature and light conditions. Under certain conditions, they are indistinguishable from one another by their leaf colour. When disparities in leaf colour occur, *xa–12* consistently has the lowest amount of pigment and *xa–18* the highest. In certain years, *xa–15* and *xa–18* could have been classified as *viridis*. Alleles *xa–12* and *xa–15* are dominant over *xa*–18.

1904 WETTSTEIN, D.
Multiple allelism in induced chlorophyll mutants. II. Error in the aggregation of the lamellar discs in the chloroplast.
Hereditas, Lund 1960 : **46** : 700–08.

Electron-microscopical examination of *xantha–12, xantha–15* and *xantha–18* revealed that these barley mutants are blocked at the same stage in plastid development and have the same aberrant type of aggregation of the lamellar discs [cf. 1903].

1905 BAUST, W. & KERN, R.
Die Meiosis der F_1-Bastarde *Hordeum spontaneum* x *Hordeum agriocrithon*. (**Meiosis of the F_1 hybrids *H. spontaneum* x *H. agriocrithon***).
Naturwissenschaften 1960 : **47** : 406–07.

Meiosis in the hybrid was found to be on the whole regular and similar to that of the parent species; seven bivalents were formed. Pollen formation was almost always normal. No differences between reciprocal hybrids were observed. These observations indicate that the parental species are closely related.

1906 SCHOOLER, A. B.
Wild barley hybrids. I. *Hordeum compressum* x *Hordeum pusillum*.
J. Hered. 1960 : **51** : 179–81.

Highly fertile allotetraploid plants were produced by treating the sterile F_1 of the above cross with colchicine.

1907 JAIN, S. K. & ALLARD, R. W.
Population studies in predominantly self-pollinated species. I. Evidence for heterozygote advantage in a closed population of barley.
Proc. nat. Acad. Sci. USA 1960 : **46** : 1371–77.

Composite cross V, a population derived from intercrosses involving 31 varieties, was analysed in terms of changes in genotypic frequencies of several markers over 18 generations, under a mating system in which self fertilization predominated. The following characters were chosen for study: black *v.* white pericarp (*Bb*); long *v.* short-haired rachilla (*Ss*); dentate *v.* nondentate lemma veins (*Gg*); blue *v.* white aleurone (Bl_1bl_1, Bl_2bl_2, complementary genes on different chromosomes); erect *v.* prostrate early growth (*Shsh*); rough *v.* smooth awns (*Rr*); brittle *v.* tough rachis (*Btbt*); and long *v.* short awn (*Ee*). The decline in heterozygosity at the marker loci was slower than expected for the observed amount of outcrossing. This result is explained on the basis of heterozygote advantage associated with segments of chromosomes. It is postulated that heterozygote advantage may have important adaptive implications in the maintenance of population variability in self-fertilizing species and hence in the evolutionary potential of such species.

1908 FAVRET, E. A.

Somatic mutations of four genes for albinism in barley induced by X-rays and ethyl methanesulphonate.

Hereditas, Lund 1960 : **46** : 622–34.

Four barley strains, each heterozygous for one gene pair conditioning albinism, were used to determine the forward mutation frequencies of the four genes alb_t, alb_{20}, alb_{14} and alb_{15} by means of treatment with X rays and ethyl methane sulphonate (EMS). Heterozygous progenies were scored for white streaks on the leaves and compared with the corresponding homozygotes similarly treated. All the genes mutated at similar frequencies with X-ray treatment, but EMS induced mutations only in alb_t. From the results obtained it is concluded that the chemical is not only selective but is a more efficient as well as a more effective mutagen than X rays.

1909 GUSTAFSSON, Å., HAGBERG, A. & LUNDQVIST, U.

The induction of early mutants in Bonus barley.

Hereditas, Lund 1960 : **46** : 675–99.

Information has been obtained on various physiological and morphological characters of 16 of the 20 early mutants selected from irradiated material of the two-rowed barley Bonus. The mutations fall into two groups: "modifying" ones, resulting in an increase in earliness of only one or two days, and "drastic" changes, resulting in a gain in earliness of up to one week. Mutants in the first group have in general produced nearly as much grain as Bonus in yield trials. Early 2 has however equalled the parent variety in yield. Two mutants, early 6 and 10, have arisen in conjunction with translocations. Early 10 is a drastic type. It has not yet been established whether the two mutants are directly associated with a breakage point. In early 6, the two breakage points are respectively situated in the short arm of chromosome 4 and the satellite of chromosome 7. The drastic mutants each represent an alteration at one of at least three and possibly four loci, *a*, *b*, *c* and (?) *d*. On the average, mutants of this type have been inferior to Bonus in yield by 8%. Mutants at *b* have produced higher yields than those at *a*. Mutants at *a*, however, are generally more resistant to lodging than *b* mutants. Concomitant with the enhancement in earliness in both groups, changes in straw structure may be observed. In comparison with Bonus, the mutants show one or more of the following properties which promote greater resistance to lodging: reduced straw length, lower number of internodes, shorter basal internodes and high internode index (length relationship between upper and basal internodes). One drastic mutant [early 8 (Svalöf 04080)] and two from the first group are considered to be more resistant to lodging than the susceptible Bonus, on the basis of observations over several years. Sv. 04080 has the shortest straw, the lowest internode number, the shortest basal internodes and highest internode index of all the mutants. It is also characterized by an altered root system, with rapid development after germination and deep penetration. In extensive trials Sv. 04080 has equalled commercial two-rowed varieties in central Sweden, while in northern Sweden it has surpassed such varieties or has even given good results where two-rowed barley cannot be grown profitably. In southern Sweden, it has been inferior in grain yield to Bonus and other widely-grown barleys by 5–10%. Its earliness, relative to that of other varieties, has remained unchanged throughout the range of cultivation. In lodging resistance, it has been superior to any commercial variety. It has however not yet been decided whether Sv. 04080 will be released commercially. The practical value of drastic *v.* modifying mutants is discussed with reference to the early mutants of Bonus and *erectoides* mutants. The importance of knowledge of the induced-mutation spectrum and of the interaction between the background of specific genotypes and mutations at different loci, combined with choice of varieties with suitable initial characters, is stressed. Finally, the induction of earlier mutants in barley is considered with respect to the applicability of the method to other crops. It is concluded that there is a general possibility of inducing drastic and modifying mutants in both diploid and polyploid species.

1910 SARVELLA, P. A. & NILAN, R. A.
The relation of the origin and number of tillers of X_1 plants to induce mutation frequencies in barley.
Genetics 1960 : **45** : 1009–10. (Abst.).

In radiobiological investigations on barley, changes in growth and development of an X_1 plant which is a mutation chimera may alter the frequencies of mutations detectable in the X_2 as chlorophyll deficiencies. In this connexion, the influence of tillering on mutation frequencies is of particular interest, a study of which has prompted Gaul to put forward the theory of diplontic selection [cf. XXIX, 3852]. The authors have carried out experiments on Haisa II to determine the relation of the origin and number of tillers to frequencies of mutation. "The viability of buds and subsequent tillering in the irradiated seed were studied with the aid of tetrazolium chloride, a vital stain. Plant survival and emergence were found to be benefited by low amounts of radiation and decreased with higher. Mutation frequencies in the X_2 seedlings were calculated on a plant, spike, and seedling basis depending on the origin of the X_1 tillers and tiller groups. Each method of measuring showed that irradiated plants with more tillers also contained more mutations except when only the apical meristems were scored. This is contrary to the above theory of diplontic selection. Possible explanations for this discrepancy will be discussed. The method which most closely approached linearity was on a per spike basis. Deviations from linearity seem to be related to a decrease of tillering and the origin of the tiller groups at irradiation."

1911 HEINER, R. E., KONZAK, C. F., NILAN, R. A. & LEGAULT, R. R.
Diverse ratios of mutations to chromosome aberrations in barley treated with diethyl sulfate and gamma rays.
Proc. nat. Acad. Sci. USA 1960 : **46** : 1215–21.

Seeds with about 15% moisture content were immersed in saturated solutions of diethyl sulphate at 30° C. for 1–2 hr. When the seeds were treated with γ rays (40–100 Kr.), they were frozen in dry ice (— 78° C.) prior to and during exposure, then hydrated in distilled water at 32° C. for 2 hr. before sowing. Plant survival for chemically-treated seed was higher at a given value for seedling injury than was found in the case of irradiation. The characteristic leaf flecking of the R_1 seedlings was not observed in M_1 seedlings from the chemical treatment. The absence of such flecking appeared to be correlated with the low frequency of chromosome aberrations scored at first mitosis in the treated seeds and in PMCs of the M_1. The partial sterility of the M_1 ears could not therefore be explained on the basis of chromosome aberrations. In contrast, irradiation induced frequent aberrations. As indicated by data on chlorophyll variants, diethyl sulphate induced a high frequency of mutations, the frequency increasing with duration of the treatment. The mutation spectrum was different for the two agents, treatment with the chemical inducing fewer *albina* and more *xantha* and *striata* mutants. The value of such a chemical mutagen in breeding is stressed.

1912 CIBUH, V. G.
(A winter barley obtained by conversion of spring forms).
Selekcija i Semenovodstvo (Breeding & Seed-growing) : 1959 : No. 5 : 50–51. [Russian].

Pallidum 48 was obtained by training local spring barley varieties from the western Ukraine for the winter habit. It outyields the standard Giaginskaja 395 by 3·2 c. per ha. and is winter hardy, resistant to drought and *Ustilago nuda* and moderately resistant to *Erysiphe, Puccinia* and *Helminthosporium.* It has large, well filled grain and does not lodge.

1913 ČENOKAL, V. G. & ŠER, B. L.
(Growing winter barley in the Ukraine).
Zemledelie (Agriculture) 1959 : No. 8 : 57–62. [Russian].

A new winter barley, Pallidum 16/60, which is earlier and more productive than Odessa 17, has been bred at Odessa. Odessa 17 is an alternative barley with high yield and good over-wintering ability.

1914 **15th Annual Report of the Malting Barley Improvement Association, Milwaukee, Wisconsin 1959** : Pp. 32.

The varieties Parkland [cf. XXVI, 2326], Forrest [XXVII, 4028], Liberty [XXVII, 4028] and Haisa II are described. Forrest and Liberty have proved unsuitable for brewing. The current status of a number of research projects is outlined briefly.

1915 SMOLJANSKIJ, I. P. & AMELINA, A. I.
(A valuable winter barley variety).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 51–52. [Russian].

A few plants of the winter barley Hibernaculum 2664 survived the severe winter of 1949–50 in Dagestan, the survivors showing heritable changes in morphological and economic characters. A new variety, Hasavirt, was selected from the above material. It outyields the original variety by 4–7 c. per ha. and is superior to it in resistance to lodging, shedding and smut. The 1000-grain and hectolitre weights of the new variety are higher.

1916 LAMBERT, J. W.
Registration of barley varieties, XV.
Agron. J. 1960 : **52** : 661–62.

Descriptions are provided of the following barleys, recently registered by the US Department of Agriculture in cooperation with the American Society of Agronomy: Arivat [XX, 309]; Forrest [cf. XXVII, 4028]; Freja [cf. XIV, 104]; Heines Hanna; and Liberty [cf. XXVII, 4028 and XXVIII, 488].

1917 TATARIN, V. F. & BULYGINA, O. K.
(Seed production at a varietal field station on a collective farm).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 19–21. [Russian].

Mention is made of the winter barley Beta 40 which is being multiplied at the Giaginskaja varietal field station in the Krasnodar territory as a preliminary to advanced trials. It is productive, winter hardy and superior to Giaginskaja 395 in resistance to *Ustilago*.

1918 TSUCHIYA, T.
Cytogenetic studies of trisomics in barley.
Japan. J. Bot. 1960 : **17** : 177–213.

All of the seven possible primary trisomics were obtained from progenies of autotriploid *Hordeum spontaneum* var. *transcaspicum* [cf. XXX, 1553]. Purple and Semierect could be clearly identified cytologically, Purple being trisomic for chromosome 6 which has a large satellite and Semierect for chromosome 7 which has a small satellite; Pseudonormal was shown to have chromosome 5 in triplicate. The extra chromosomes of Bush, Slender, Pale and Robust have not yet been identified. The trisomics showed surprisingly high pollen fertility (93–97%) with the exception of Pale (72%). Seed fertility was also relatively high in all seven types although it varied from year to year and type to type. Germination of seeds from selfed plants, from trisomic x normal diploid and from normal diploid x trisomic crosses was very high, ranging from 80·3% in Pale and Slender to 91·9% in Bush.

Meiosis was similar in all seven types; the occurrence of trivalents or univalents, chromosome lagging and micronuclei is recorded. An investigation of nucleolus-chromosome relationships established that chromosome 6 has the strongest nucleolar-organizing capacity, followed by chromosome 7. Nucleolar-organizing capacity was also indicated for some other chromosomes. Transmission of the extra chromosomes through the ovules varied from type to type but was fairly high in all types; no transmission through the pollen was observed. Trisomic plants were more frequently produced from small seeds than from large ones and all the types were vigorous.

From genetic studies the independence of six linkage groups was established and evidence obtained for the location of groups III and VII on the extra chromosome of Bush. Trisomics Slender, Pale, Robust and Pseudonormal carry linkage groups I, VI, IV and II respectively on their extra chromosomes. Semierect carries group V on its extra chromosome 7, while Purple is thought to carry on its extra chromosome 6 the new linkage group established by other workers from reciprocal translocation studies [cf. XXVIII, 2963]; reference is made to unpublished studies by Kramer and by Burnham who have respectively located genes x_n (*xantha* seedling) and *o* (orange lemma) in this group.

1919 RAMAGE, R. T. & DAY, A. D.
Separation of trisomic and diploid barley seeds produced by interchange heterozygotes.
Agron. J. 1960 : **52** : 590–91.

Most of the trisomics produced by interchange heterozygotes were found in the lighter seed-weight classes. A seed blower may therefore be used to obtain seed lots containing a high frequency of trisomics.

1920 TSUCHIYA, T.
A preliminary note on cytological abnormalities in barley.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 49–56.

Descriptions of the following meiotic aberrations are given: (1) asynapsis in a "slender" trisomic of *Hordeum spontaneum* var. *nigrum*, apparently caused by the extra chromosome; (2) desynapsis in the X_2 of the above variety which had been subjected to 13,500 r. of X rays; (3) asynapsis in syncytes; (4) partial asynapsis in spring barleys in which meiosis commenced in February-March when the temperature was very low; (5) tetraploid sporocytes in X-ray-induced desynaptics; and (6) syncyte formation in trisomics of *H. spontaneum* var. *nigrum* and some of their derivatives.

1921 KAMRA, O. P.
Chromatin extrusion and cytomixis in pollen mother cells of *Hordeum*.
Hereditas, Lund 1960 : **46** : 592–600.

The material used in these studies consisted of partially and completely sterile mutants of *erectoides*–14 and *erectoides*–23. In some sterile mutants as many as 40% of the PMCs examined showed evidence of chromatin extrusion and cytomixis. At pachytene, chromatin material could be seen protruding from the main chromatin mass at one or more points, and at diacinesis and metaphase I the protrusions were visible as Feulgen-positive bodies budded from the bivalents. They commonly became detached and were found in the cytoplasm either of the same PMC or in that of a neighbouring cell. Evidence of torn bivalents, cells with additional chromosome fragments, cells with extra bivalents and chromatin links between adjacent PMCs in different stages of meiosis is presented.

1922 DOMAŃSKI, R.
Zależność żywotności pyłku od niektórych czynników siedliska. (**Dependence of pollen viability on certain environmental factors**).
Acta Soc. Bot. Polon. 1959 : **28** : 277–84.

In studies conducted at Poznań, Poland, the degree of pollen inviability in barley (*a*) was increased by drought at the time of stem elongation, (*b*) was not reduced by increased nitrogen supply, (*c*) showed no relation to number of empty spikes and (*d*) was increased when the phosphorus supply was reduced. The number of empty spikes increased when the nitrogen supply prior to the onset of drought was high but was unaffected by a reduction in phosphorus.

1923 KAMRA, O. P.
Occurrence of binucleate and multinucleate pollen mother cells in *Hordeum*.
Hereditas, Lund 1960 : **46** : 536–42.

The frequencies of binucleate and multinucleate PMCs observed were 2·4 and 0·2% respectively. The observations were originally made on the mutants *erectoides*–14 and *erectoides*–23, but subsequent investigations revealed about equal frequencies in normal barley. No sign of degeneration was observed in any of the nuclei of a multinucleate PMC. Meiosis in such cells was sometimes synchronized and sometimes not. The condition is attributed to the failure of cell-wall formation at premeiotic mitosis.

1924 WATANABE, S., NAKAGAWA, M., GOCHO, H. & NISHIO, K.
(**Genetical studies on ear type and grain shape in naked-barley varieties. I. Variation in the development of the young ear in naked-barley varieties of different ear types**).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 81–88. [Japanese].

A detailed biometrical study is presented of the course of development of the ears of three varieties with ears of average length and one with short ears.

1925 STEBBINS, G. L.
Cytological evidence for the nature of action of hooded gene in barley.
Science 1960 : **132** : p. 1550. (Abst.).

Histological and cytological differences between the hooded and awned genotypes during floret development are described.

1926 ROHDE, C. R. & PULHAM, C. F.
Heritability estimates of winter hardiness in winter barley determined by the standard unit method of regression analysis.
Agron. J. 1960 : **52** : 584–86.

The estimates were made on the basis of the average survival of bulk F_2s and bulk F_3s from 18 winter-barley varieties crossed in a diallel series. The F_2s were grown in five tests, three being at Lincoln, Neb., one at Hays, Kans., and the fifth at Lafayette, Ind., during 1951–52. The F_3s, which were derived from F_2 plants which had not been exposed to winter-killing conditions, were tested at Lincoln and North Platte, Neb., in 1953–54 and 1954–55. An average heritability estimate of 85% was obtained for the total number of 153 progenies whose parents covered a wide range in winter hardiness, while the average estimate for the 78 progenies whose parents represented a somewhat narrower range in hardiness was 49%. Tests made at one-half the usual rate of sowing did not permit a reliable evaluation of hardiness.

1927 MOSEMAN, J. G. & SCHALLER, C. W.
Genetics of the allelic series at the Ml_a locus in barley and cultures of *Erysiphe graminis* f. sp. *hordei* that differentiate these alleles.
Phytopathology 1960 : **50** : 736–41.

Gene Ml_a in Algerian conditioned resistance to cultures CR3 and 061 of the above pathogen. A gene in Ricardo, conferring resistance to CR3 but not to 061, was considered to be allelic to Ml_a and was designated Ml_a3. Culture CR3 contained two genes for avirulence, A_a and A_a3, which were respectively complementary to Ml_a and Ml_a3 in the host. Culture 061 carried A_a and a gene for virulence, V_a3, which was complementary to Ml_a3.

1928 Hamilton, D. G., Clark, R. V., Hannah, A. E. & Loiselle, R.
Reaction of barley varieties and selections to root rot and seedling blight incited by *Helminthosporium sativum* P.K. and B.
Canad. J. Pl. Sci. 1960 : **40** : 713–20.

The following technique was used in testing reactions to *H. sativum* (*Cochliobolus sativus*) at the Genetics and Plant Breeding Research Institute, Ottawa, Ont. Surface-sterilized seeds were grown in a mixture of 90% sterilized white silica sand and 10% sand-corn meal inoculum of an isolate collected in the Ottawa area. Disease ratings of the seedlings were recorded after 21 days in a glass-enclosed chamber kept at 20–22° C. and a high humidity. Of the 600 varieties and selections tested, 51 were classified as resistant, Anoidium, Br. 3962–4, Lenta and Opal B receiving the highest rating in this respect.

1929 Loiselle, R. & Shands, R. G.
Influence of maternal tissue on loose smut infection of hybrid barley kernels.
Canad. J. Bot. 1960 : **38** : 741–46.

A study of the influence of maternal tissues on the development of *Ustilago nuda* has been conducted on artificially inoculated kernels of the susceptible variety Odessa, two resistant varieties, Anoidium and Trebi, and their direct and reciprocal F_1 hybrids. It was noted that mycelium was present in the embryo as well as various other regions of the kernels of Odessa but was not present in the embryo, aleurone or endosperm of the resistant varieties. In Odessa x Anoidium, the mycelium developed abundantly in the susceptible maternal tissues and some was present in the embryo itself. In the reciprocal cross, which has the same genotype, no mycelium was observed in the embryo or any other hybrid tissue. These results indicate that the nature of the maternal tissue does influence infection of hybrid embryos, though this influence appears to be secondary in importance to that of the genotype of the embryo itself.

1930 McFadden, A. D., Kaufmann, M. L., Russell, R. C. & Tyner, L. E.
Association between seed size and the incidence of loose smut in barley.
Canad. J. Pl. Sci. 1960 : **40** : 611–15.

Since small and medium-sized grains have been found to carry a greater amount of loose-smut infection than large ones, it is suggested that seed stocks to be used in breeding and variety testing should each have the same proportions of small seed removed so as to guard against misleading results.

MILLETS AND SORGHUMS

1931 Raman, V. S. & Krishnaswamy, D.
Studies on the interspecific hybrid of *Pennisetum typhoides* x *P. purpureum*. V. The cytology of an allotriploid plant.
J. Indian bot. Soc. 1960 : **39** : 382–85.

The allotriploid ($2n = 21$) was produced by crossing *P. typhoides* with an allotetraploid to which the genome formula AAA′B had been assigned, AA and A′B representing the contributions by *P. typhoides* and *P. purpureum*, respectively [cf. XXVII, 4042]. Meiotic study of the allotriploid suggested that it contained chromosomes belonging to genomes A and A′ only.

1932 Clapp, A. L. *et al.*
Kansas grain sorghum performance tests 1959.
Bull. Kans. agric. Exp. Sta. 1960 : No. 420 : Pp. 28.

Information on the yield and performance of six varieties and 54 hybrids in 1959 Kansas trials is reported. The three-year average performance of the superior varieties in each district is also presented.

1933 Shulkcum, E.
Grain sorghum tests conducted in Virginia in 1959.
Res. Rep. Va. agric. Exp. Sta. 1960 : No. 36 : unpaginated. (Mimeographed).

Twenty-five hybrids were tested against two old varieties in three localities. On the basis of the results for 1959 and the previous three or four years, the hybrids Texas 610, Texas 620, Texas 660, DeKalb C44A and DeKalb E56A are considered to be outstandingly promising.

1934 MOORE, R. F.
Hybrid sorghum holds promise.
Qd. agric. J. 1960 : **86** : 593–95.

American F_1 hybrids have given encouraging results in initial tests in Queensland.

1935 RAUTOU, S. & COGNOT, J.
Le sorgho hybride. (**Hybrid sorghum**).
Progr. agric. vitic. 1960 : **77** : 230–34, 252–58.

Some of the problems concerned with the production of hybrid sorghum are discussed. Details are given of the male-sterile lines which have been introduced from Texas to the Montpellier Plant Breeding Station.
A 1959 trial at this station is reported; marked heterosis, in terms of increased yield, was found in hybrids between four male-sterile lines and the variety Redbine 60. In another trial, 14 out of 15 American hybrids outyielded the standard variety Combine 60. The highest yields were obtained from H–590 and SH1 (*ms* Combine 605 x Redbine 60).

1936 HADLEY, H. H.
A genetic method for producing seedless hybrid broomcorn.
Agron. J. 1960 : **52** : 610–11.

The development of seedless, glumeless hybrid broomcorn would appear to be desirable from the standpoints of both growers and manufacturers. An outline is given of a possible method of obtaining such a type, by means of the gene pairs Sh_2 and Sh_3 for seed shedding in *Sorghum virgatum* [cf. XVIII, 247] and male sterility dependent upon the sterile type of cytoplasm derived from milo sorghum and the gene pair $ms_c ms_c$ from Combine Kafir [XXIX, 2667]. The presence of either $sh_2 sh_2$ or $sh_3 sh_3$ results in nonshedding. The shedding caused by Sh_2 together with Sh_3 is brought about by abscission at a callus layer below the seed. It is suggested that three lines of each desirable broomcorn variety should be developed, as follows: lines A, $ms_c ms_c\ Sh_2 Sh_2\ sh_3 sh_3$ + sterile cytoplasm (male sterile, nonshedding); B, $ms_c ms_c\ Sh_2 Sh_2\ sh_3 sh_3$ + fertile cytoplasm (male fertile, nonshedding); and C, $ms_c ms_c\ sh_2 sh_2\ Sh_3 Sh_3$ + fertile cytoplasm (male fertile, nonshedding). Intravarietal or A x C intervarietal hybrids, which would be both male sterile and shedding, would be used for commercial production. A lines could be maintained by crossing with B lines. B and C lines could be maintained by selfing or open pollination in an isolation block. Suggestions are made as to back-crossing procedures for developing the three types of lines.

1937 FRANZKE, C. J., SANDERS, M. E. & ROSS, J. G.
Influence of light from an infra-red bulb on the mutagenic effect of colchicine on *Sorghum*.
Nature, Lond. 1960 : **188** : 242–43.

True-breeding diploid mutants were obtained at the South Dakota State College when colchicine-treated seedlings were exposed to continuous infrared illumination for 7 days at about 78° F. immediately after treatment. This illumination was not however the only factor precipitating the appearance of the mutants, since none were obtained when colchicine-treated seedlings were grown on agar + complete nutrient supply or agar with distilled water, instead of on sand with tap water. Mutants arising after infrared exposure were morphologically similar to those obtained previously from colchicine-treated seedlings grown in an unshaded greenhouse. The results provide a clue to the variability found in the occurrence of colchicine-induced mutants in earlier greenhouse experiments. In addition to the genotype, external conditions such as light, cultural medium and temperature affect the induction of true-breeding mutants. Induction of such mutants has proved to be a useful method in sorghum breeding. [Cf. XXIX, 2670].

1938 VENENI, M.
Poznatky pri novom šl'achtení ciroku metlového Sesíleš 14/50 a význam jeho zavedenia do pestovania. (**Observations on a new selection of sorghum, Sesíleš 14/50, and the importance of its introduction into cultivation**).
Pol'nohospodárstvo 1960 : **7** : 411–22.

Sesíleš 14/50 grows to a height of 180–210 cm. and is easier to harvest than the taller varieties commonly grown; the new variety also has a higher yield and better quality.

1939 ROSS, J. G., SANDERS, M. E. & FRANZKE, C. J.
Asynapsis in *Sorghum*.
Hereditas, Lund 1960 : **46** : 570–80; Genetics 1960 : **45** : p. 1008. (Abst.).

A plant of Experimental 3 proved to be a chimera with a sector carrying a mutant gene, designated as^3, for asynapsis. The mutation was inherited as a simple Mendelian recessive. During meiosis, univalents varying in number from 0 to 12 lagged at anaphase I, being subsequently pulled apart by neocentric action. Transverse or longitudinal separation at the centromere resulted, depending on the orientation of the univalent at the equator. Univalents which had divided at the first division were sometimes torn apart at anaphase II and formed fragments.

1940 MAUNDER, A. B.
Fertility restoration of cytoplasmic-genetic male-steriles in *Sorghum vulgare* Pers.
Diss. Abstr. 1960 : **21** : LC Card Mic 60–2227 : p. 17. (Abst.).

In order to study the frequency of fertility restoration, completely ♂ sterile Combine Kafir 60 (ms_c + sterile cytoplasm) was crossed with 104 varieties. Seed-set data on selfed F_1s revealed considerable variation in fertility both within and between varieties. "The average frequency of the Ms_c factor for all entries was 0·61 and 0·38 for complete restoration." Kafir and forage sorghums were low in restoration in comparison with other grain-sorghum types and the Sudan grasses. With varieties of recent hybrid origin, all degrees of restoration were obtained. Variations within a variety were attributed to the original parentage or mutation. This variability probably persisted because of lack of selection pressure in the presence of normal cytoplasm.

The results of studying the following aspects are summarized: (1) fertility restoration in relation to such factors as complete floret abortion in which part of the inflorescence showed abnormal development of the ♀ and ♂ organs, differences in fertility between the tillers and primary culm, and sectoring within a panicle with respect to ♂ sterility; and (2) seed set under conditions of bagging in comparison with the percentage of viable pollen as indicated by staining. "Above 60% viable pollen, partial fertility was difficult to estimate by seed set. Seed set generally overestimated male fertility although pollen dehiscence was apparently reduced significantly by low fertility."

In addition, "the inheritance of fertility restoration was studied with both pollen and seed set readings being used to analyze F_1 and F_2 testcrosses, selfed testcrosses, F_2's and F_3's. An allele test of seven known restorers as well as five succeeding segregating generations of some partial fertile selections were studied. All tests continued to verify that a single recessive, ms_c, produced male sterility in the presence of sterile cytoplasm. The allele test suggested duplicate factors for partial fertility." In the selections studied for five succeeding generations, "partial fertility was expressed as a uniformly low class and a high partial class which was likely induced by more than one genotype. Testcrosses involving the hybrids, RS 608 and RS 610, as well as three-way crosses of *ms* Martin by RS 610 and *ms* CK 60 by RS 608 suggested that both steriles may be carrying different dominant restorers since maximum restoring effect was observed in the three-way crosses. A hypothesis based on two epistatic restorers plus three additional modifiers was presented to explain the testcross results."

1941 BROOKS, M. H.
A study of the mode of gene action in cytoplasmic male sterility: semi-quantitative analyses of the free amino acids in anthers of fertile and cytoplasmic male sterile *Sorghum.*
Genetics 1960 : **45** : p. 978. (Abst.).

An attempt is being made to determine the biochemical basis of cytoplasmic ♂ sterility and to elucidate the nuclear-cytoplasmic interaction involved, use being made of several varieties of *S. vulgare* which are available as both fertile and sterile isogenic lines. One approach is through paper chromatography of anther extracts to discover which, if any, metabolites may accumulate as the result, presumably, of altered enzyme action. So far as the "microspore-prepollen" stage, which is terminal for the sterile lines, is concerned, no qualitative differences have been detected between fertile and sterile counterparts with respect to aspartic acid, glutamic acid, serine, threonine and alanine. Quantitative differences in contents of these aminoacids were found on a dry-weight basis between the fertile and sterile lines, depending upon the variety, but these did not appear to bear any obvious relationship to sterility as such. Analyses of all the common aminoacids are to be followed by determinations of nucleic acids, nucleotides, purines and pyrimidines, sugars and sugar phosphates; all studies will be repeated for the earlier stages of meiosis. The results will be compared with those concerning substances involved in fertility restoration.

1942 BACSA, P.
A seprűcirok bugák rendellenes fejlődésének okai a nemesítés tükrében. **(Causes of abnormal development in broom-corn panicles as reflected in breeding work).**
Diss. Budapest 1959 : p. 65 : from Hungar. agric. Rev. 1960 : **9** : No. 2 : p. 13. (Abst.).

Abnormal panicle formation appeared to be due to environmental rather than genetical causes.

Preliminary results of recurrent selection for quality have shown little promise.

1943 Mathur, R. S., Atheya, S. C., Jain, J. S. & Mathur, S. C.
Varietal reaction of jowar to grain smut in Uttar Pradesh.
Curr. Sci. 1960 : **29** : 402–03.

Information is given on the reactions of grain-sorghum varieties to *Sphacelotheca sorghi* in tests at the Laboratory of the Plant Pathologist, Kanpur.

RICE

1944 Butany, W. T., Bhattacharyya, R. K. & Daiya, L. R.
Inheritance of dwarf character in rice and its interrelationship with the occurrence of anthocyanin pigment in various plant parts.
Indian J. Genet. 1959 : **19** : 64–72.

Profuse tillering dwarf, a new mutant which appears to have arisen as a result of spontaneous mutation in the variety T1222–12, is described. Its inheritance is shown to be governed by a single recessive gene, designated *dpt.*

F_2 segregations of 54 normal : 10 dwarf, 15 normal : 1 dwarf and 3 normal : 1 dwarf respectively, were obtained in crosses of another dwarf type, T432, with three normal parents, T90, T1242 and GEB24. These segregations are shown to be due to the interaction of three recessive genes provisionally designated d_a, d_b and d_c; the presence of any two of these is necessary for the production of the dwarf character. The following genic constitutions are suggested for the parent varieties: T432, $D_aD_ad_bd_bd_cd_c$; T90, $d_ad_aD_bD_bD_cD_c$; T1242, $D_aD_aD_bD_bD_cD_c$; and GEB24, $D_aD_ad_bd_bD_cD_c$. The inheritance of anthocyanin pigmentation in different plant parts was also studied in the cross T432 x T90. It was shown that the character is governed by 1–4 complementary genes, which are inherited independently of the dwarf genes.

1945 Takahashi, N. & Oka, H.
(On the intrinsic factors determining germination rate in rice grains).
Nogaku Kenkyusho Iho/Bull. Inst. agric. Res. Tohoku Univ. 1959 : **10** : 207–11. [Japanese].

F_0-F_2 generations of the cross Ou 195 (slow germinating) x Ou 200 (quick germinating) were raised. The variances for germination rate were partitioned into components for cytoplasm, pericarp, embryo, endosperm and dominance, and it was concluded that the principal control of germination rate was exercized by the pericarp.

1946 Misro, B., Seetharaman, R. & Richharia, R. H.
Studies on world genetic stock of rice. I. Patterns of anthocyanin pigment distribution.
Indian J. Genet. 1960 : **20** : 113–17.

The pigmentation pattern of 796 rice varieties from 30 countries was studied. A total of 719 varieties were grouped into 57 classes on the basis of the presence or absence of pigments in 15 plant parts. The remaining 77 lines could not be grouped as each formed a distinct class by itself. Pigmentation of all 15 parts was not observed in any variety. The significance of various combinations that occurred, and certain genetic factors influencing such combinations, are discussed briefly.

1947 Henderson, M. T., Yeh, B. P. & Exner, B.
Further evidence of structural differentiation in the chromosomes as a cause of sterility in intervarietal hybrids of rice, *Oryza sativa* L.
Cytologia, Tokyo 1959 : **24** : 415–22.

Chromosome behaviour at anaphase I was studied in 12 intervarietal hybrids of cultivated rice. Two types of unusual behaviour were found, namely bridges accompanied by acentric fragments and bridges without fragments. Since the latter were also found in each of three homozygous varieties in approximately the same frequency as in the hybrids, it is concluded that this behaviour is not abnormal and does not indicate structural differentiation, as was previously suggested [cf. XXVII, 1340]. It is more probably caused by chance delay in terminalization of chiasmata, though it may be influenced to some extent by the genotype.

Bridges accompanied by fragments were found at very low frequencies in nine of the 12 hybrids, indicating the presence of paracentric inversions. "These results provide proof of widespread structural differentiation in the chromosomes of cultivated rice varieties and suggest strongly that the partial sterility which occurs commonly in intervarietal hybrids is caused by complex inversions of the included type."

1948 Escuro, P. B.
The response of rice varieties to season of planting.
Philipp. Agric. 1960 : **44** : 1–10.

"The relations between number of days to heading and plant height and of these characters with their respective annual ranges were studied and used as bases for predicting the seasonal variation of 251 varieties in bimonthly plantings under irrigated field conditions. The correlation coefficient between days to heading and its annual range for the March planting ($r = \cdot 970$) was sufficiently high for use as a basis for predicting annual heading range from days to heading and, hence, the seasonal reaction of rice varieties. The r values between days to heading and its annual range for the other plantings, between plant height and its annual range, and between heading and plant height for all plantings were all significant but still low for prediction purposes.

"By plotting the date of planting against days to heading of any variety that has been classified into any maturity group in March planting, the days to heading of that variety, when planted any time between March and December, could be approximately determined with the use of the curves for the maturity groups."

[Author's summary].

1949 OKA, H.-I. & CHANG, W.-T.

Survey of variations in photoperiodic response in wild *Oryza* species.

Bot. Bull. Acad. sin. 1960 : **1** : 1–14.

Strains of *O. sativa* f. *spontanea*, *O. perennis* and the other species investigated at Taichung, Taiwan, were mostly sensitive to photoperiod. Compared with f. *spontanea*, *O. perennis* had later heading dates and shorter critical day lengths, and also larger within-population variances for these two measurements. With respect to critical day length a latitudinal cline was established for *O. perennis* and another for f. *spontanea*. In each cline, the lower the latitude the shorter the critical day length. Strains of *O. perennis* generally showed a high sensitivity to photoperiod, i.e. degree of requirement for a critical day length necessary for flower initiation. The *spontanea* type had a relatively low sensitivity, and a larger within-population variance for sensitivity than *O. perennis*. These differences are discussed in relation to adaptation to environmental conditions.

1950 BORASIO, L. & CORBETTA, G.

Le radiazioni ionizzanti nella creazione di nuove varietà di riso. **(Ionizing radiations in the creation of new varieties of rice).**

Riso, Milano 1960 : **9** : 10–12.

Seeds of three cultivars, R. Bersani, Rizzotto and Roncarolo, treated with radiation from Co^{60} and a betatron gave rise to plants that were 15–20 days later in maturity and showed varying degrees of sterility. The F_2 contained plants with a variety of anomalies, those from the betatron treatment displaying a certain number of characters thought to be of economic interest. Doses in the region of 30,000 r. were found to be the most effective for dry seeds.

1951 KAO, K.-N., HU, C.-H., CHANG, W.-T. & OKA, H.-I.

A biometrical-genetic study of irradiated populations in rice; genetic variances due to different doses of X-rays.

Bot. Bull. Acad. sin. 1960 : **1** : 101–08.

Seeds of the *japonica* rice Taichung 65 were exposed to different doses of X rays and individual-plant data were recorded on heading date, plant height, panicle length and other agronomic characters in the X_2 and X_3. No selection was applied, except for discarding X_2 plants showing sterility or extreme dwarfness. In the X_2, the induced variance increased with the dose, but in the X_3 this variance reached the maximum value with a dose of 20 Kr. and decreased as the dose increased. Heritability values showed a similar tendency. It is suggested that this reduction in variability in the X_3 may have been largely the result of natural elimination of unadapted mutations in the X_1 and X_2, and that if such an elimination does in fact occur, breeders may prefer to select in the X_3 rather than the X_2.

1952 RICHHARIA, R. H.

Origins of cultivated rices.

Indian J. Genet. 1960 : **20** : 1–14.

Evidence is cited in support of the hypothesis that *Oryza sativa* and *O. glaberrima* have evolved from *O. perennis*. Unpublished studies mentioned include Gopalakrishnan's finding that plants resembling *O. stapfii* appeared in the F_2 of a cross between the Orissa type of *O. perennis* and *O. glaberrima*, and the selection, by Madhaven Nair, of plants resembling cultivated rice from *O. perennis* var. *cubensis* x *O. perennis* (Orissa type) progenies.

1953 KIHARA, H.

Considerations on the origin of cultivated rice.

Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 68–83.

Recent work, in particular studies by the author and his colleagues, throwing light on the evolutionary history of rice are reviewed. The classification of *Oryza* into four sections on the basis of the surface structure of the flowering glumes, proposed by Roževic, is adopted. The species are either diploid ($2x = 24$) or tetraploid ($2x = 48$). Six species of section *Sativa*, including *O. sativa*, have the genomic constitution

AA; *O. officinalis*, *O. minuta* and *O. latifolia*, all from section *Sativa* too, have the respective genome constitutions, CC, BBCC and CCDD. Studies of interspecific hybridization have shown that *O. sativa* can be crossed with all the other species of section *Sativa* but with no species in the other sections. Chromosome conjugation in F_1 interspecific hybrids of the AA group is regular, 12_{II} being formed. However, while the hybrid of *O. glaberrima* x *O. breviligulata* is fully fertile, the F_1 hybrids from either of these species and *O. sativa* is completely sterile. It is concluded that cultivated rice has a double origin: (1) *O. sativa* from *O. sativa* var. *spontanea* and perhaps also *O. perennis* in Asia; and (2) *O. glaberrima* from *O. breviligulata* in Africa.

1954 Shastry, S. V. S., Ranga Rao, D. R. & Misra, R. N.
Pachytene analysis in Oryza—I. Chromosome morphology in *Oryza sativa*.
Indian J. Genet. 1960 : **20** : 15–21.

Information on the length, arm ratios, and size and distribution of chromomeres is presented for each of the twelve bivalents of *O. sativa* 'Norin 6' [Ministry of Agriculture and Forestry 6]. Because of the difficulty encountered in fitting the data to Nandi's hypothesis concerning the origin of *O. sativa* [cf. VII, 419], in which a basic chromosome number of five is proposed, it is suggested that the question of the basic number should be reexamined.

1955 Carpena, A. L. & Ramirez, R. A.
Interchanged chromosomes in reciprocal translocation stocks of rice.
Philipp. Agric. 1960 : **44** : 116–24.

"Twenty-seven stocks of rice heterozygous for reciprocal translocations were cytologically studied to determine the number of chromosomes involved in each translocation. Nine stocks were found to each have an interchange of two pairs of chromosomes as shown by the ring or chain of four configuration at diakinesis and metaphase I. However, not all plants in these stocks showed such configurations. Some showed only bivalents at the same stage. The ring forming plant had an average pollen sterility of around 55 per cent and an ovule abortion of around 65 per cent, while plants with only bivalents had ovule and pollen sterilities ranging from 3·89 to 22·86 per cent and 8·08 to 18·98 per cent, respectively.

"Eighteen stocks showed 12 bivalents at diakinesis. Seven of them had relatively low sterility. The other 11 stocks had plants with sterilities as high as those of the ring forming plants.

"In general, high pollen abortion was accompanied by low seed set. In the highly sterile group (plants with more than 50 per cent sterility) ovule abortion was generally higher than pollen abortion."

[Authors' summary].

1956 Seshu, D. V. & Karibasappa, B.
The chromosomes of *Oryza ridleyi* Hook.
Curr. Sci. 1960 : **29** : p. 326.

In a study at Cuttack, India, plants of *Oryza ridleyi* were found to be tetraploid, with $2n = 48$. A high degree of sterility was noted, and was attributed to tetraploidy and the presence in many spikelets of vestigial anthers; it was also strongly affected by season, being lowest during the humid months of October and November.

1957 Chao, C.-Y., Li, D. & Hu, W. L.
A desynaptic mutant in rice.
Bot. Bull. Acad. sin. 1960 : **1** : 29–36.

In a mutant induced by thermal-neutron treatment, synapsis was normal at early meiotic prophase in PMCs but during diplotene the chromosomes separated, varying numbers of univalents being seen at diacinesis and metaphase I. This abnormal behaviour depended upon a single recessive gene.

1958 Yamagata, M.
(Studies on the upper limit of leaf number and grain number on the main stem of rice varieties. VI. The influence of different growing periods).
Yamaguchi Daigaku Nogakubu Gakujutsu Hokoku/Bull. Fac. Agric. Yamaguti Univ. 1959 : No. 10 : 1241–44. [Japanese].

A comparative study with five varieties showed that later sowing caused a decrease in heading period, this effect being more pronounced in late varieties. Later sowing resulted in fewer leaves and more grains on the main stem.

1959 Noguchi, Y.
Studies on the control of flower bud formation by temperature and day-length in rice plants. IV. Flower bud formation in response to alternation of temperature conditions.
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 101–06.

The date of heading in two early-maturing thermosensitive Japanese varieties, Norin 11 [Ministry of Agriculture and Forestry 11] and Iburiwase [Iburi Early] occurred 40 days after sowing at 30° C. and 80 days after sowing at 20° C. Periods at the higher temperature also accelerated heading under alternating temperature conditions. A positive correlation was found between temperature and leaf development; in general, the higher the temperature, the greater was the number of leaves on the stem at the time of heading.

In another trial, the higher temperature accelerated heading in two late-maturing, photosensitive varieties, Norin 18 and Zuiho [Abundance]. However, the extent of leaf development was virtually constant under all temperature régimes in the case of these two varieties [cf. XXX, 1591 and 2719].

1960 Matsushima, S. & Tanaka, T.
(Studies in crop science in respect of forecasting the yield of rice. LV. A method for the early discrimination of unfertilized grains).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1960 : **28** : 365–66. [Japanese].

Fertilized grains begin to accumulate starch in the mesocarp as early as 24 hr. after anthesis and this can be detected by staining with iodine.

1961 Tsai, H. Y., Phillips, A. T. & Williams, V. R.
Molecular weights of crystalline amyloses from certain rice varieties.
J. Agric. Food Chem. 1960 : **8** : 364–68.

Analysis of Caloro, Rexoro, Zenith and Century revealed varietal disparities in amylose molecular weight, which may possibly be related to differences in water absorption and alkali dispersibility reported for these varieties by other investigators.

1962 Kadam, B. S. & D'Cruz, R.
Genic analysis in rice — III. Inheritance of some characters in two clustered varieties of rice.
Indian J. Genet. 1960 : **20** : 79–84.

From crosses between 389D and 389E it is concluded that: (1) the intensity of clustering of the spikelets is influenced by minor genes; (2) two genes, *A* (anthocyanin) and *C* (chromogen), produce colour in the apiculus and both genes are also required together with a specific gene *Lsc* for the development of colour in the sheath and stigma; (3) black colour of the lemma and palea is dominant to brown and is conditioned by four complementary genes, Hb_a, Hb_b, Hb_c and Hb_d, the absence of any one of which results in brown colouring; (4) rounded spikelet shape is dominant to oval and controlled by four complementary genes Kr_a, Kr_b, Kr_c and Kr_d; and (5) two duplicate genes, G_1 and G_2, condition short glumes. A linkage group A–G_1–Kr_a was identified and assigned to linkage group IV. [Cf. XII, 675 and VII, 423].

1963 Nagato, K., Ebata, M. & Tanda, Y.
(Studies on the quality of the grains of rice grown early in the season).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1960 : **28** : 359–62. [Japanese].

A detailed study was made of the dimensions and quality characteristics of the grains of seven varieties grown (1) at the normal time and (2) early in the season. The detrimental effects of early culture were less pronounced in hard-grained varieties.

1964 Pelshenke, P. F. & Hampel, G.
New methods of evaluating cooking qualities of rice.
Rice J. 1960 : **63** : No. 9 : p. 22.

An account is given of the evaluation of small samples of white rice from different varieties by (1) determining the swelling coefficient by extraction of a specific hydrated fraction of starch and measurement of its iodine coloration, and (2) making an "oryzogram" so as to obtain information on the consistency of the swollen grains. For (2), a panimeter is used. These methods have been applied at the Federal Research Institute for Grain Processing, Western Germany.

1965 Tsunoda, S.
A developmental analysis of yielding ability in varieties of field crops. III. The depth of green colour and the nitrogen content of leaves.
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 107–11.

The leaves of rice and sweet potato varieties adapted to heavy manuring had a higher nitrogen content, and were coloured more deeply, than leaves of varieties adapted to light manuring [cf. XXX, 2400].

1966 Shiratori, K., Matsumoto, N Matsuoka, Y. & Yamaguchi, H.
(Studies on the physiological characters of rice varieties in connexion with resistance to autumn decline. VI. On the growth of the overground and underground parts on reducing soils).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1960 : **28** : 351–52. [Japanese].

The growth of seedlings of 15 varieties transplanted on to strongly reducing soils was studied. Little correlation was noted between root and top growth but some evidence was obtained that top growth was correlated with the capacity of the roots to oxidize H_2S. [Cf. XXVIII, 4264].

1967 BALDACCI, E. & CORBETTA, G.
Miglioramento genetico-sanitario della produzione sementiera del riso. (**Genetic and sanitary improvement of seed production in rice**).
Riso, Milano 1960 : **9** : No. 10 : 9–13.

In emphasizing the importance of healthy seed, the authors indicate the main diseases affecting rice in Italy and complain that, in spite of the excessive number of new varieties released in recent years, little attention has been given to breeding cultivars resistant to disease.

1968 LATTEREL, F. M., TULLIS, E. C. & COLLIER, J. W.
Physiologic races of *Piricularia oryzae* Cav.
Plant Dis. Reptr. 1960 : **44** : 679–83.

On the basis of the susceptibility reactions of ten rice varieties, 15 races of *P. oryzae* were identified within a group of 165 isolates obtained from rice-growing areas in America, Europe and Asia.

1969 SÜDI, J. & PODHRADSZKY, J.
Rizsfajták Piricularia-rezisztenciájának gyors elbírálása üvegházi vizsgálattal. (**A greenhouse method for the rapid determination of *Piricularia* resistance in rice varieties**).
KisérlÜgy. Közl. 1959 : **52A** : No. 2 : 3–16.

The method described involves inoculation by brushing a conidial suspension on to the upper surface of the first leaf, 9–12 days after sowing. Two types of resistant lesions and two of susceptible lesions were distinguished, allowing plants to be classified as resistant, susceptible and intermediate or variable. Since plant reaction varied with age and environmental conditions, it was found advisable to include the highly susceptible variety Dunghan Shali in the tests as a standard. The method takes 15–20 days in all and can be employed at any time of year. The classification of 12 varieties and 20 strains of Kendzó as resistant or susceptible according to their frequency in the three groups agreed with the results of field experiments. For varieties which fell predominantly into the intermediate class, however, field experiments would be necessary to determine the exact degree of resistance.

1970 VEGA, M. R. & OBIEN, S. R.
The response of some lowland rice varieties to 2,4-dichlorophenoxyacetic acid (2,4-D).
Philipp. Agric. 1960 : **44** : 45–65.

In a trial involving seven varieties, the highest susceptibility to damage by 2,4-D was found in Peta, while the greatest tolerance was found in B–E–3. It was evident, however, that if spraying is carried out at the correct stage of growth and at the recommended application rate, variety will be a minor consideration in deciding whether or not to use 2,4-D. Only where an early treatment at a high application rate is likely to be required, should the use of Peta be avoided. Details are given of the effects of the herbicide on growth, flowering, morphology and yield in all seven varieties.

1971 RICHHARIA, R. H. & GOVINDASWAMI, S.
Flowering and photo-sensitiveness in *Oryza perennis* Moench.
Rice News Teller 1960 : unpaginated.

Observations at the Central Rice Research Institute, Cuttack, India, have shown *O. perennis* to be sensitive to short days. It is suggested that photosensitivity in varieties of *O. sativa* may have been derived from *O. perennis*, assuming this wild species to be the ancestor of cultivated rice. The photoperiodic insensitivity found among other varieties of *O. sativa* would in this case have arisen later through mutation and subsequent selection under conditions of cultivation.

1972 BUI-HUY-DAP & NGHIEM PHU CHUAN
(**The light phase of some rice varieties from the Democratic Republic of Vietnam**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 81–99. [Bulgarian].

[Cf. XXX, 2734].

1973 SHAH, S. S.
Response to photoperiod of four wild species of the genus *Oryza*.
Indian J. Genet. 1959 : **19** : 98–106.

The response of *O. perennis*, *O. officinalis*, *O. australiensis* and *O. breviligulata* to three short-day treatments, of 8, 9 and 10 hr., has been studied at the Central Rice Research Institute, Cuttack. *O. perennis* failed to flower under natural or short-day conditions. The other three species flowered significantly earlier in a short-day environment than in natural conditions. *O. officinalis* was the most sensitive of the three; plants kept in a 9 hr. day flowered 16 days earlier than did the controls. Within the three short-day treatments, there were no significant differences as regards the number of days from sowing to flowering. Other characters, namely plant height, panicle length, the number of grains produced, total number of tillers and number of reproductive tillers, were also studied and it was observed that all except the last two characters mentioned were significantly influenced by short-day treatment. The results are discussed with reference to the flowering period, geographical distribution and adaptive significance of the species.

1974 ALEŠIN, E. P. & APROD, A. I.
(The effect of temperature upon seed germination of the rice varieties grown in the Kuban').
Fiz. Rasten. (Phys. Pl.) 1960 : **7** : 358–62. [Russian].

Varietal differences in soil-temperature requirements are described.

FORAGE GRASSES

1975 **Experiments in Progress. Annual Report of the Grassland Research Institute, Hurley, near Maidenhead, for 1958–9** (1960) : Pp. 112.

A number of varietal trials of ~~various~~ grass species are reported.

1976 GASPARINI, M.
Le possibilità di miglioramento della produzione foraggera nell'alta collina e montagna appenninica. (**Possibilities of improvement of the forage production in hill and mountain areas of the Apennines).**
Sementi elette 1960 : **6** : No. 5 : 14–24.

One of the methods employed is the introduction of improved varieties of some of the main species for use in mixtures, special mention being made of ecotypes of *Trifolium hybridum* from northern France and of leafy selections of *Lolium perenne*.

Report of the Sixteenth Southern Pasture and Forage Crop Improvement Conference, Mississippi State University State College, Mississippi, June 9–11, 1959 : Pp. 36. (Mimeographed).

1977 *Burton, G. W. Methods of exploiting heterosis in forages. (pp. 2–3).*

A brief review is given of the methods used commercially for hybrid seed production in various forage crops.

1978 *Taylor, N. L., Harlan, J. R., Buckner, R. C., Cope, W. A. & Craigmiles, J. P. Some approaches to breeding difficult to handle species. (pp. 3–5).*

J. R. Harlan, discussing the improvement of obligate apomicts, reported that King Ranch bluestem was used as male in a cross with a facultative variety in an attempt to improve the former; one hybrid was obtained. Since genomes of both *Bothriochloa intermedia* and *B. ischaemum* are present in King Ranch a number of crosses were made between these two species. The F_1 from *B. intermedia* ($4n$) x *B. ischaemum* ($4n$) is highly sterile but vigorous and leafy and is tetraploid. The F_1 from *B. intermedia* ($4n$) x *B. ischaemum* ($6n$) is heptaploid and is vigorous, hardy and immune to rust, and sets abundant seed by apomixis. Brief mention is made of hybrids produced using sexual tetraploids obtained by (1) chromosome doubling of sexual diploids by means of colchicine, (2) pollinating emasculated diploids with pollen from tetraploids, and (3) crossing facultative apomicts.

R. C. Buckner reported on crosses made between ryegrass and tall fescue to incorporate in the latter the palatability and nutritive quality of ryegrass. Of 150 hybrids obtained, all were male sterile and also largely female sterile. Fertile plants were obtained by (1) colchicine treatment and (2) back crossing to tall fescue. In grazing trials, the better-grazed lines were selected for inbreeding. Selected inbred lines were included in further grazing trials and their parents polycrossed. Chromosome counts of the five hybrids obtained by (1) showed one to be amphidiploid with $2n = 56$, three to have $2n = 70$ and one, $2n = 42$. The 56-chromosome plant produced 25–50% viable pollen and produced approximately 1000 viable seeds when outcrossed to tall fescue and to fertile backcrossed hybrids. Fertile plants obtained from this seed exhibit ryegrass and tall fescue characters and include some promising material.

It is reported by W. A. Cope that progenies from crosses of *Lespedeza cuneata* with *L. hedysaroides*, *L. inschanica* and *L. latissima* are now in the F_5. The F_4 hybrids were superior to *L. cuneata* in stem size and leafiness but their average yield was only 80% of that from *L. cuneata*. The best hybrids however were superior to inbred lines of *L. cuneata* and when crossed with the latter gave greater yields than crosses between *L. cuneata* inbreds. Individual F_4 and F_5 plants selected for low tannin, high protein, fine stems or leafiness were back crossed to outstanding *L. cuneata* inbreds and further selections are being made from the segregating progenies.

A brief account of interspecific hybridization in *Sorghum* was given by J. P. Craigmiles. With the aim of breeding hybrid Sudan grass, crosses have been made between *S. sudanense* 'Tift' and *S. arundinaceum*. Plants from *S. vulgare* x *S. sudanense* 'Tift' and *S. vulgare* x *S. arundinaceum* are being studied.

N. L. Taylor reported on interspecific crosses in *Trifolium* [cf. XXX, 1266].

1979 *Hanson, A. A.* et al. *A regional approach to a breeding program.* (*pp. 5–13*).

Reference is made by C. R. Owen to two new strains, B230 and 430, developed from *Paspalum dilatatum*; they gave relatively high yields of seed. Strain 430 is less variable in percentage seed set than B230. In the former, variation was found to be due to environmental fluctuations but, in the latter, variation is heritable.

E. C. Bashaw gave an account of studies on reproduction in four biotypes of *P. dilatatum* [cf. XXIX, 418 and 2719].

I. Forbes reviewed his own and other workers' studies on hybridization within and between *Paspalum* species; he considers that the erect, yellow-anthered form of *P. dilatatum* has the genetic constitution AABB or $A_1A_1A_2A_2$, while the common form has AABBC or $A_1A_1A_2A_2C$.

G. W. Burton described some radiation-induced mutants of prostrate *P. dilatatum* [cf. XXX, 1206].

1980 SMITH, T. J., GISH, P. T. & WILLIAMS, A. S.
Varietal tests of sudangrass and pearl millet in Virginia, 1954–1959.
Res. Rep. Va. agric. Exp. Sta. 1960 : No. 38 : Pp. 33.

The results of trials at four centres representing three principal agricultural regions in Virginia are given.

1981 BARCLAY, P. C.
Perspectives in pasture plant breeding in New Zealand.
Proc. NZ Grassl. Ass. 1959 : No. 21 : 115–21.

A discussion of grass and clover breeding under way or planned in New Zealand is given, the emphasis being laid on breeding for extended season of growth, improved efficiency of water utilization, quality and competitive ability.

1982 DAVIS, W.
Sir George Stapledon—an appreciation.
J. Brit. Grassl. Soc. 1960 : **15** : 273–74.

A short biography is given of the Founder President of the British Grassland Society who died in September 1960.

1983 MURRY, M. J.
Environmental vegetative heterosis.
Agron. J. 1960 : **52** : p. 609.

A Yucatan strain of *Amaranthus* planted at Ithaca, NY, grew much larger than the native weeds *A. retroflexus* and *A. hybridus* and under long-day conditions continued vegetative growth unabated, until freezing conditions set in. In F_1 hybrids, the reaction of local strains of *A. hybridus* to long days was completely dominant over the reaction of the Yucatan strain to approximately equal days and nights. On the basis of these observations, it is suggested that lawn grasses, permanent pasture grasses, certain forage species and green-manure crops could be deliberately maladjusted to photoperiod, by the breeder, to prevent flowering and assure continued vegetative growth. Seed production of a modified strain would have to be in the contrasting photoperiod. Development of such maladjusted strains might be accomplished expeditiously by X or neutron irradiation.

1984 HITTLE, C. N.
La producción de nuevas variedades de forrajes. **(The production of new varieties of forage crops).**
Suelo tico 1960 : **12** : No. 45 : 45–47.

An outline of the use and production of synthetic varieties of forage crops is presented.

1985 BONVICINI, M.
Specie da foraggio nella attività selettiva dell'Istituto di allevamento vegetale di Bologna. **(Fodder species in the breeding activities of the Bologna Plant Breeding Institute).**
Sementi elette 1960 : **6** : No. 5 : 56–64.

The outline refers to the oat Angelica, the rye Cinquecento [Five-hundred] and the barley Ventitre [Twenty-three], all early and suitable for forage production; to the forage sorghums Satiro and Saturno [cf. XXVIII, 4296] and the sweet sorghums Sirri and Soave, all of which are better in quality, and often also in yield, than the hybrid sorghums; to the field bean Vesuvio [XXX, 4430]; to a lucerne selected from an old plantation near Bologna, distinguished by longevity, yielding ability and forage quality; and to selection work in progress with *Onobrychis* and *Hedysarum*.

1986 Singh, D. N. & Godward, M. B. E.
Cytological studies in the Gramineae.
Heredity 1960 : **15** : 193–97.

The chromosome numbers of 53 tropical and warm-temperate species, belonging to *Andropogon, Eleusine, Eragrostis, Panicum, Paspalum, Setaria* and 19 other genera of the Gramineae, are listed. In the case of two genera, *Calyptochloa* and *Tetrapogon*, and 29 species, numbers are reported for the first time. Several other counts do not correspond with those given by other authors [cf. XXVI, p. 527]. Brief reference is made to evidence of somatic instability in *Paspalum dilatatum* and to the presence in Nigeria of interspecific hybrids derived from *Andropogon gayanus* x *A. tectorum*.

1987 Gould, F. W.
Chromosome numbers in southwestern grasses. II.
Amer. J. Bot. 1960 : **47** : 873–77.

Chromosome counts are reported for 45 species found in the southwestern part of the USA and in adjoining areas. Thirty-three of the numbers are reported for the first time for the taxa or differ from those found by other investigators. Among the *n* numbers given are the following: *Festuca megalura*, 21; *Eragrostis barrelieri*, *E. lehmanniana*, 30; *E. cilianensis*, 10; *Muhlenbergia porteri*, 20; *Sporobolus airoides*, *ca.* 45; *S. flexuosus*, 19; *S. pyramidatus*, *S. vaginiflorus*, 27; *Bouteloua aristidoides*, *B. simplex*, 20; *B. trifida*, 10; *Chloris andropogonoides*, *Ch. berroi*, 20; *Ch. latisquamea*, 20, *ca.* 31; *Ch. subdolichostachya*, 20, *ca.* 33; *Ch. submutica*, 40; *Ch. verticillata*, *ca.* 28; *Eleusine indica*, 9; *Cenchrus parviceps*, 17; *Digitaria sanguinalis*, 18, 27; *Panicum capillarioides*, *P. firmulum*, *P. ramisetum*, 18; *P. repens*, 27; *Setaria geniculata*, 18, 36; and *S. viridus*, 9. [Cf. XXIX, 2707].

1988 Gruber, F.
Adatok a füvek virágzásbiológiájához. **(Data on the floral biology of grasses).**
KisérlÜgy. Közl. 1958 : **1** : 5–26.

From a review of the literature, supplemented by the author's own observations, tabulated data are presented showing numbers of flowering culms per plant in two-year-old plants, pollination relationships, number of spikelets and flowers per ear, time and duration of flowering, minimum temperature for flowering, shape, size and number of anthers and colour of flowers in a number of grass species.

1989 Tateoka, T.
Cytology in grass systematics: a critical review.
Nucleus, Calcutta 1960 : **3** : 81–110.

This comprehensive review opens with an account of the status of grass systematics before the application of cytological information. The initial impact of cytology upon grass taxonomy is then described and the progress made with the aid of cytology is exemplified by the Ehrharteae and Danthonieae. A survey of the chief results of caryosystematic research on the Gramineae follows, with particular reference to controversial genera. Finally, it is shown how cytological investigation has also assisted in bringing about a renewed appreciation of the significance of morphological features.

1990 Emecz, T. I.
Some physiological characteristics and the agronomic importance of Diptera damage to grasses.
J. Brit. Grassl. Soc. 1960 : **15** : 315–22.

Different varieties and genotypes of six grass species were studied for reaction to damage by shoot-fly larvae at the Welsh Plant Breeding Station, Aberystwyth. Different varieties within species and different genotypes within varieties showed varying degrees of susceptibility to damage and ability to recover from it. The greatest losses occurred in varieties with a small number of tillers.

1991 Almgård, G.
Experiments with *Poa*. I. Studies of *Poa longifolia* Trin. as a fodder grass and as a component in interspecific hybrids.
Kungl. LantbrHögskolans Ann. 1960 : **26** : 77–119.

In studies at the Royal Agricultural College of Sweden, *P. longifolia*, a tufted species with $2n = 42$, has shown good pollen quality even when selfed, although number of seeds/panicle, germination percentage and 1000-seed weight are reduced on selfing. Germination percentage varies less from strain to strain than in the apomicts *P. ampla*, *P. compressa* and *P. pratensis*. *P. longifolia* shows promise as a green fodder crop, giving high yields good in chemical composition when cut twice a year. Crosses with diploid sexual pollen parents ($2n = 14$) gave the following descending order of readiness of hybridization: *P. chaixii*, *P. hybrida*, *P. remota*. Chromosome numbers in the hybrids showed a marked peak at $2n = 28$–30, with slight peaks at $2n = 35$, 49 and 56. Of four hybrids from *P. longifolia* x *P. pratensis* 'Graubünden' ($2n = \pm 68$), three of them with

$2n = \pm 56$ and one with $2n = \pm 75$, all had good pollen, all were intermediate between the parents in plant size, and one was equal to *P. pratensis* in seed set, two were intermediate between the parents and one was inferior to *P. longifolia*. Five hybrids from *P. longifolia* x *P. pratensis* 'Skandia II' ($2n = 62$–74), were also intermediate between the parents but were weaker than the above hybrids and were poor in pollen quality and seed set. All nine hybrids were stoloniferous. Aposporous embryo sacs were found in those with the best seed set, normal embryo sacs in a hybrid with somewhat lower seed set and none in those with poor seed set.

No hybrids with *P. ampla* ($2n = 64$) or *P. compressa* ($2n = 50$) were obtained.

Polyploid species have been found to tolerate higher X-ray doses than diploid. So far, X irradiation has yielded smaller plants with fewer panicles and reduced seed set.

1992 Cleveland, R. W., Starling, J. L., Murphy, R. P., Hanson, A. A. & Leffel, R. C.

Orchardgrass breeding in the Northeast. 1. A regional approach to the evaluation of clones, polycross progenies, and experimental synthetics.

Bull. Cornell agric. Exp. Sta. 1960 : No. 955 : Pp. 34.

Details are given of the parentage of synthetic varieties of *Dactylis glomerata* developed for the north-eastern region of the USA. On the basis of trials of the polycross progenies of the component clones of US Pasture Laboratory synthetics, three new early, medium and late maturing synthetics were constituted and designated, respectively, Pa. Early I, Pa. Medium II and Pa. Late III; the latter was released under the name Pennlate [cf. XXVIII, 4281].

The tabulated results are given of three years' trials of parent clones and their polycross progenies conducted in three areas within the region. Only in the medium and late groups were superior clones found and these will be used in the production of synthetics. An appendix of nine tables gives information on growth characters, colour, maturity and disease reaction of the clones tested, as well as parent-progeny correlations.

1993 Zijp, M. J.

Some observations on a possible X-ray mutant in cocksfoot (*Dactylis glomerata*).

Euphytica, Wageningen 1960 : **9** : 222–24.

Among 27 X_2 families obtained by selfing 1400 X_1 plants was one completely smooth-leaved plant which had no teeth on either the leaves or the spikelets but was otherwise normal. The plant showed good self fertility with no visible inbreeding depression in the X_3. The smooth-leaved character, designated *glabra*, was recessive.

1994 Nordenskiöld, H.

The mode of segregation in a family of hexaploid *Phleum pratense*.

Hereditas, Lund 1960 : **46** : 504–10.

The plant selected for this study belonged to the second isolated generation of an individual originating from Omnia. It was highly self-fertile and had given a simplex segregation ratio of 2339 green : 825 white seedlings. Segregation however was found to occur in all of 27 progeny plants examined, demonstrating an autopolyploid mode of segregation. From the ratios obtained the mother plant is postulated to segregate for green *v.* white at two independent loci, one simplex and the other duplex or triplex. The duplex condition is considered more likely for the second locus although, with the small amount of material available, this could not be proved. The continuous variation of segregation ratios in the progeny of an autopolyploid individual segregating for chlorophyll deficiency in more than one locus is demonstrated graphically, using the data obtained from the 27 progenies studied.

1995 Lowe, C. C., Murphy, R. P., Fortmann, H. R. & Dunn, G. M.

A regional approach to breeding and evaluation of smooth bromegrass for use and adaptation in the Northeast.

Bull. Cornell agric. Exp. Sta. 1960 : No. 954 : Pp. 34.

An account is given of breeding and evaluation of *Bromus inermis* varieties and synthetics under three regional projects covering the period 1950–59. All the experimental synthetics tested were equal or superior both in total-season and in aftermath yields to the southern varieties in commercial use. Two polycross progeny yield trials conducted at four centres showed marked progeny x location interaction, although some progenies were superior at all centres. The synthetic combinations being constituted on the basis of these trials are listed. Clone-progeny correlations in respect of growth habit, maturity and disease reaction are considered, and the effectiveness of the polycross technique in breeding is discussed.

1996 Al-Ansary, M. M.

Variation in seed and seedling characters of bromegrass, *Bromus inermis* Leyss., in relation to environment.

Diss. Abstr. 1960 : **20** : LC Card Mic 60–977 : p. 3913.

The results of greenhouse experiments on five commercial varieties, one synthetic and 65 individual-plant progenies indicated that such factors as seed viability, soil moisture, nitrogen supply and diseases may have an important influence upon seedling stand and vigour. Control of such factors is therefore advocated when testing for seed and seedling characters with a view to improving seedling establishment in breeding. The 15 progenies selected and the synthetic were superior in germination and seedling vigour to the five varieties.

1997 Christie, B. R. & Kalton, R. R.

Recurrent selection for seed weight in bromegrass, *Bromus inermis* Leyss.

Agron. J. 1960 : **52** : 575–78.

Mean seed weights of top-cross seed produced by 203 clones varied from 0·60 to 1·26 g. per 300 seeds. In 1957, ten of the highest and ten of the lowest clones as regards seed weight, as evaluated by the top-cross data, were planted in separate isolated polycross blocks. In 1958, the polycross progenies, clonal progenies of the parental clones and two controls representing the mean of the original population of 203 clones were studied with respect to seed weight in spaced plantings. For the first and second groups of clones, the mean seed weights of the polycross progenies ranged from 0·69 to 1·62 g. and from 0·44 to 1·29 g. per 300 seeds, respectively. The mean difference between the two progeny groups was significant at the 1% level. On the basis of estimated percentages of genotypic variance, it was concluded that further progress by recurrent selection would be feasible [cf. XXX, 4000].

1998 Naylor, B.

Species differentiation in the genus *Lolium*.

Heredity 1960 : **15** : 219–33.

The results of a study of four nuclear and six morphological characters in *L. perenne*, *L. italicum* and their F_1 and F_2 hybrid derivatives indicate that these two open-pollinated forms do not constitute distinct species. This suggestion is supported by a reanalysis of Jenkin's data [XXIV, 3040–3044 and XXVI, 1349, 1350] and is extended further to include a third open-pollinated form, *L. rigidum*. All three forms "are probably best regarded as subspecies." However, data on three self-pollinating types, *L. remotum*, *L. temulentum* and *L. loliaceum*, indicate that they may justifiably be regarded as distinct species.

1999 Tarkowski, C.

Badania nad odmianami botanicznymi *Festuca rubra* L. (**Investigations on botanical varieties of *F. rubra* L.**).

Ann. Univ. M. Curie-Skłodowska : Sect. E. : 1958 : **13** : 269–96.

In studies of *F. rubra* ssp. *eurubra* vars. *vulgaris*, *glaucescens*, *juncea*, *arenaria*, *barbata* and *planifolia*, ssp. *fallax* vars. *subcaespitosa* and *nigrescens* and ssp. *trichophylla* var. *glareosa*, intervarietal differences were found in plant height, length of basal leaves, pubescence of sheath and other morphological characters, and also in length of vegetative period, number and size of vascular bundles in the leaves and stems and degree of lignification. Seed set in single isolated panicles was 56·8% in var. *planifolia*, 14·3% in *vulgaris*, 5·4% in *barbata* and *subcaespitosa* and very low in the other varieties; when 3–5 panicles were isolated together, seed set was somewhat higher. Somatic chromosome numbers were 42 and 56 in var. *vulgaris*, 28 and 42 in *barbata* and 42 in the remaining varieties. Chemical analyses showed that the leaves and panicles are richer than the stems in protein and that the highest ash content occurs in the leaves, suggesting that breeding should be directed towards increasing leaf and panicle size and decreasing stem length. The varieties *vulgaris* and *planifolia* were highest in fodder value, followed by *subcaespitosa* and *nigrescens*, in that order; other varieties are recommended for use as turf.

2000 Anderson, D. E.

Taxonomy and distribution of the genus Phalaris.

Diss. Abstr. 1960 : LC Card Mic 60–1809 : p. 4496. (Abst.).

Fifteen species were distinguished. On the basis of morphology, these were grouped into four complexes. Chromosome numbers were determined for ten species. Within *Ph. arundinacea*, *Ph. minor* and *Ph. coerulescens*, at least two levels of polyploidy were found.

2001 Townsend, C. E.

Sterility in sudangrass : II. Random and nonrandom partial-sterility.

Agron. J. 1960 : **52** : 639–42.

The term random partial sterility was applied in the case of plants in which sterile and fertile florets were distributed at random within the panicle. The reproductive organs of such plants were apparently normal, although about 50% seed failure and 50% pollen abortion usually occurred. The S_1s segregated into fertile and partial-sterile individuals with a 1 : 1 ratio. Cryptic structural hybridity is thought to be the most likely explanation of this type of partial sterility. In plants with nonrandom partial sterility, sterility was not distributed at random within the panicle and pistil development was abnormal. Complete fertility or complete sterility was not obtained in the progenies from selfing such plants. Fertility was completely or nearly completely restored by using fertile plants as either the ♂ or ♀ parent. Nonrandom partial sterility is considered to be under the control of genes, the action of which is modified by some unknown factor or factors. [Cf. XXX, 4014].

2002 Bogdan, A. V.
A molasses grass variety trial.
E. Afr. agric. For. J. 1960 : **26** : 132–33.

A report is given on a variety trial of *Melinis minutiflora* at the Grassland Research Station, Kitale, Kenya.

2003 Johnson, B. L.
Natural hybrids between *Oryzopsis* and *Stipa*. I. *Oryzopsis hymenoides* x *Stipa speciosa*.
Amer. J. Bot. 1960 : **47** : 736–42.

Information is given on the taxonomic status, morphology and cytology of natural sterile hybrids ($2n = 56$) of *O. hymenoides* ($2n = 48$) x *S. speciosa* ($2n = 64$). Both parents show regular bivalent formation. In the hybrids, meiosis was characterized by a lack of pairing, bivalents being seen only occasionally. Pollen abortion was complete. No evidence of natural amphiploidy or introgression was obtained.

2004 Streetman, L. J. & Wright, N.
A cytological study of blackgramagrass, *Bouteloua eriopoda*.
Amer. J. Bot. 1960 : **47** : 786–93.
Streetman, L. J.
A study of the chromosome number, microsporogenesis, megasporogenesis, embryo sac development, and embryogeny in black gramagrass, *Bouteloua eriopoda* (Torr.) Torr.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1252 : 4251–52. (Abst.).

Thirty-four of thirty-five collections made in Arizona and New Mexico had $2n = 20$, normal meiosis and a pollen stainability approaching 100%. The remaining accession had $2n = 28$, with a maximum chromosome association of $7_{III} + 3_{II} + 1_{I}$ at diacinesis and 0–8 laggards at anaphase I. No quadrivalents were observed in this accession, which, although it had about 67% pollen stainability, was highly sterile. These findings support the view that the basic number in the genus is $x = 10$. The normal development of the ♂ and ♀ gametophytes was indicative of sexual reproduction, while the high degree of variation between and within accessions suggested that the species is predominantly cross-fertilized. The $2n = 28$ strain may possibly have originated as an aneuploid, produced by a triploid resulting from the union of an unreduced ♀ gamete and reduced ♂ gamete. The aneuploid strain had a decumbent and open type of growth which would enable it to multiply vegetatively.

2005 Hartley, W. & Slater, C.
Studies on the origin, evolution, and distribution of the Gramineae. III. The tribes of the subfamily Eragrostoideae.
Aust. J. Bot. 1960 : **8** : 256–76.

In further studies of grass distribution [cf. XXIX, 419 and 2729], maps are presented showing the world distribution of the tribe Eragrosteae (sensu str.) and of the subfamily Eragrostoideae within which it is included. Species of the subfamily are relatively abundant in the flora of all arid regions with high winter temperatures and summer or nonseasonal rainfall. In general, there is a close relationship between the distribution pattern and climate. However, the subtribe Garnotiinae and the tribe Phaenospermeae do not conform to this pattern. It is suggested that these taxa should not be included within the Eragrostoideae, a conclusion supported by cytological and anatomical data obtained by other authorities.

2006 Brown, W. V. & Pratt, G. A.
Hybridization and introgression in the grass genus *Elymus*.
Amer. J. Bot. 1960 : **47** : 669–76.

The production of artificial F_1 hybrids between (1) *E. virginicus* and *E. canadensis*, (2) *E. virginicus* and *E. interruptus* and (3) *E. canadensis* and *E. interruptus*, yielding some seeds, makes it reasonable to assume that similar plants found in nature are true hybrids. Artificial hybrids constituted the basis of comparison in a study of natural populations in the Austin region, Tex. Scatter-diagram analyses indicated that the great variability of *E. virginicus* in this area is due to introgression by

E. canadensis and possibly also by *E. interruptus*. It is suggested that probably the named varieties and wide range of genotypes within *E. canadensis* and *E. virginicus* may be introgressant types resulting from hybridization between these species and others occurring sympatrically in the eastern USA.

2007 Hein, M. A.
Registration of varieties and strains of other grasses, IV.
Agron. J. 1960 : **52** : p. 662.

Recently registered in the USA, *Elymus junceus* 'Vinall' is described [XXX, 4024].

2008 Ueda, K.
Studies on the physiology of bamboo, with reference to practical application.
Bull. Kyoto Univ. For. 1960 : No. 30 : Pp. 167.

Studies on the size, fertility and germination of pollen grains of Indian and Japanese bamboo species are reported.

2009 Connor, H. E.
***Agropyron* x *wallii* a natural hybrid in New Zealand.**
Trans. roy. Soc. NZ 1957 : **84** : 757–60.

A botanical description is given of *A.* x *wallii* ($2n = 35$), a natural hybrid between *A. enysii* ($2n = 28$) and *A. scabrum* ($2n = 42$). The hybrid is sterile and, in morphological characters, is intermediate between the parents; it is thought that *A. enysii* was probably the female parent.

2010 Gillett, J. M. & Senn, H. A.
Cytotaxonomy and infraspecific variation of *Agropyron smithii* Rydb.
Canad. J. Bot. 1960 : **38** : 747–60.

Canadian investigations on the taxonomy, geographical distribution, variation and cytology of western wheat grass are reported. The pubescent variety *molle* was found to have no distinct geographical distribution within the species and is therefore reduced to the rank of a form. Somatic chromosome counts on 62 plants collected from the entire area of distribution indicate constant octoploidy, with $2n = 56$. Only minor irregularities were found to occur during meiosis. Attempts to hybridize *A. smithii* with several other *Agropyron* species failed and attempts to induce self fertilization were also unsuccessful.

2011 Dewey, D. R.
Salt tolerance of twenty-five strains of *Agropyron.*
Agron. J. 1960 : **52** : 631–35.

Strains representing 13 species and *A. trachycaulum* x *Hordeum jubatum* were studied with respect to (1) forage yield when grown under controlled conditions of salinity in 14′ x 14′ field basins, and (2) germination percentages in Petri dishes containing soil with the same degrees of salinity as in the field tests. Wide interspecific differences in tolerance were found. The rankings by the two methods, however, showed dissimilarities and it is concluded that prediction of mature-plant tolerance from germinability in saline soil is not valid. Intraspecific differences were pronounced in both tests. Selection within species in field basins may therefore be expected to result in the development of more tolerant strains.

LEGUMINOUS FORAGE PLANTS

2012 Garza T., R. & Buller, R. E.
Comportamiento de leguminosas y zacates forrajeros en la región del Bajío. (**Performance of legumes and forage grasses in the Bajío region**).
Foll. téc. Secretaría Agric. Ganad., Méx. 1960 : No. 41 : Pp. 24.

The results from a series of yield trials conducted in the Bajío region are reported. The outstanding variety in two lucerne trials was Tanverde. Three other Mexican varieties, Oaxaca, Atlixco and Hojaseo also performed well. Pure stands of lucerne outyielded red and Ladino clovers as well as ten different grass-legume mixtures. In row-planted trials, perennial sweet Sudan grass and *Sorghum almum* produced higher yields under a 3-cut system than common sweet Sudan grass.

2013 Hulewicz, T.
Metody i osiągnięcia w hodowli roślin pastewnych w Stanach Zjednoczonych A.P. (**Methods and achievements in fodder plant breeding in the USA**).
Postępy Nauk Roln. 1960 : No. 2 : 117–29.

An account, based on a study tour, is given of the general organization of research and of the work being done in some of the main centres, mention being made of many of the cultivars and hybrids of lucerne and clover produced there.

2014 Haussmann, G.
La certificazione delle sementi foraggere e il miglioramento degli ecotipi di leguminose foraggere. (**Certification of forage seed and improvement of the ecotypes of forage legumes**).
Sementi elette 1960 : **6** : No. 5 : 26–42.

Reference is made to the certification scheme put out by the OEEC [cf. XXIX, 1764] and to the desirability of the adoption of some similar scheme for superior ecotypes. A system is suggested whereby it would be possible to effect improvements in any ecotype over a period of years while maintaining it under certification.

2015 FRAHM-LELIVELD, J. A.
Chromosome numbers in leguminous plants.
Acta bot. neerl. 1960 : **9** : 327–29.

Somatic chromosome numbers are reported for three species of the Mimosaceae, seven of the Caesalpinaceae and 35 of the Papilionaceae.

2016 WÖHRMANN, K.
Vergleichende Untersuchungen über das photoperiodische Verhalten di- und autotetraploider Stämme von *Trifolium incarnatum* L. (**Comparative investigations on the photoperiodic behaviour of diploid and autotetraploid strains of *T. incarnatum* L.**).
Naturwissenschaften 1960 : **47** : p. 238.

Under long-day conditions, tetraploids reached the flowering stage more quickly than diploids and with a short day the reverse effect was observed. The tetraploids attained on the average a lower plant weight than the diploids under long-day conditions and a greater weight with the short-day treatment. Observations on 2*n* and 4*n* plants of serradella and red clover revealed similar reactions.

2017 SIKKA, S. M., MEHTA, R. K. & SWAMINATHAN, M. S.
Studies on induced polyploids in forage crops. II. Colchicine treatment methods for berseem and senji.
Indian J. Genet. 1959 : **19** : 90–97.

The effectiveness of several colchicine treatments in inducing polyploidy in *Trifolium alexandrinum* and *Melilotus indica* has been studied. In the former, immersion of shoots of 4-day-old seedlings in 0·1% colchicine gave the highest percentage of pure tetraploids (30%). Treatment of whole seedlings with 0·05% colchicine for 8 hr. at room temperature gave the highest percentage of mixoploids (63·5%). *M. indica* responded best to whole-seedling treatment with 0·05% colchicine for 4 hr. at room temperature. In both species, the optimum age of seedlings for colchicine treatment was 4 days. The different variables involved in standardizing a suitable colchicine treatment method are discussed and it is pointed out that proper after-care of colchicine-treated seedlings is of great importance in ensuring the success of the treatment.

2018 CASTLE, M. E. & REID, D.
A comparison of lucerne varieties in south-west Scotland.
J. Brit. Grassl. Soc. 1960 : **15** : 281–86.

In trials of 5 early, 3 midseason and 2 late varieties, the early varieties gave the highest yields of dry matter and crude protein, with Flandria in the top position. Orchesienne gave the second highest yield of dry matter and the third highest yield of crude protein. Rhizoma, a late variety, was the second highest yielder of crude protein, but ranked only fourth in its dry-matter yield. Relatively low yields were obtained from New Zealand B and Provence; the latter was retarded in its first growth by cold weather in 1957 and 1958.

2019 JOHANSEN, Ø. & VESTAD, R.
Forsøk med lusernestammer. (**Trials of lucerne strains**).
Forskn. Fors. Landbr. 1960 : **11** : 507–17.

Among 24 Norwegian and introduced lucernes tested in pure stands and in mixtures with timothy at various Norwegian stations, the Canadian strain Rhizoma was hardiest and gave highest yields in all three harvest years.

Report of the Sixteenth Alfalfa Improvement Conference held on July 28–30, 1958 at Ithaca, New York : Pp. 119. (Mimeographed).

In addition to the contributions summarized below, the publication includes brief reports of various committees and a section on pollination and seed production.

2020 *Miller, J. Incompatibility studies of diploid* Medicago falcata. (*p. 2*).

Five *M. falcata* plants were used in a study of self and cross-incompatibility relationships. An analysis of the results suggested that there was no single *S* locus responsible for incompatibility. There was some evidence that two gene loci, operating independently and inherited in an independent manner, were responsible for incompatibility.

2021 *Sahni, V. M. & Davis, R. L. Self-incompatibility studies in alfalfa.* (*pp. 3–8*).

Two self-incompatible diploid *Medicago sativa* plants were used in a study of the inheritance of this character. On the basis of the results obtained from a considerable number of crosses, a compatibility system is proposed in which at least two loci with multiple alleles are involved. A definite epistatic relationship between the allelic series is suggested. It is also suggested that the pollen incompatibility reaction is under sporophytic control.

2022 *Kehr, W. R. & Graumann, H. O. Specific combining ability in alfalfa.* (*pp. 9–16*).

Preliminary data obtained at Lincoln, Nebraska, from a diallel series of crosses among six selected clones high in general combining ability, and from a partial diallel series involving 13 other selected clones, are reported. The average performance of two-clone synthetics indicated that general combining ability (for yield) was similar in the six clones selected for this character. All clones in both series expressed specific combining ability for forage yield. Yields of 4-clone synthetics could be predicted on the basis of data obtained from 2-clone synthetics in the 6-clone diallel trial. Selected 4-clone synthetics based on these predictions are being produced and are to be compared with parental synthetics and check varieties in future tests. The average yield performance of a number of intervarietal crosses was equal or less than the yield of the varieties themselves, except in the case of Lahontan. Intervarietal crossing does not thus appear to offer possibilities for increasing forage yield.

2023 *Pearson, L. C. & Elling, L. J. Predicting synthetic varietal performance from single cross information.* (*pp. 17–20*).

Tabulated information is given on the yield, winter injury, disease resistance and persistence of synthetic lucerne varieties and the single crosses constituting each synthetic. The clones used for this investigation are among those being studied in the Minnesota lucerne-breeding programme. The synthetics were inferior to the average of the single crosses in forage yield and most other characters studied. As regards prediction accuracy, the authors indicate that "synthetic performance can probably be predicted on the basis of single cross performance for some characters where inheritance is apparently conditioned by additive factors".

2024 *Wilsie, C. P. Hybrid vigor, yield variance and growth habit inheritance in divergent alfalfa crosses.* (*pp. 21–33*).

A high level of heterosis for forage yield was shown by crosses between clone 1973, a prostrate, wild-type Turkish selection and clones 538 and 42, both of which are erect, vigorous, cultivated-type selections. In these crosses, prostrate growth habit was dominant over erect habit. Erect growth, which was more pronounced in the third year of growth than in younger plants, could generally be restored by back crossing once to the erect parent. There was considerable variability in segregating progenies of the various crosses effected. The significance of these results for practical breeding programmes is discussed. It is suggested that greater efforts should be made "towards the development of methods which will make possible a more effective utilization of hybrid vigor in synthetic and hybrid varieties of alfalfa".

2025 *Murphy, R. P. A study of the variation in open-pollinated fertility among individual plants of Narragansett. A progress report.* (*pp. 34–39*).

Wide variation in seed set was observed in a field of Narragansett lucerne at Riverton, Wyo. The variations did not appear to be associated with any obvious morphological characters. Studies on differences in open-pollinated fertility within a group of 77 selected plants obtained from the Wyoming population are now in progress at Ithaca, NY.

2026 *Couch, H. B. Crown and root rots of alfalfa.* (*p. 40*).

Methods for the control of *Ditylenchus dipsaci* are discussed. Selections from the variety Lahontan and from crosses of resistant clones are being tested in North Carolina and Virginia.

2027 *Fulkerson, J. F. Studies on bacterial wilt of alfalfa.* (*pp. 42–43*).

Two isolates of *Corynebacterium insidiosum* were found to be differentially virulent, the degree of virulence depending upon the test clones of lucerne used. Results obtained from recycle tests with the bacteria and from the reaction of clonal test plants suggested that some isolates of the pathogen may be highly unstable. Other data indicated that the concentration of inoculum is not as critical in bacterial wilt as is the period during which the plants are subjected to the inoculum. The fact that bacterial wilt is not a rapid, systemic-type disease in mature plants may explain the apparent lack of effect observed when different concentrations of the pathogen were applied.

2028 *Renfro, B. L. & Sprague, E. W. Reaction of* Medicago *species to certain alfalfa pathogens.* (*pp. 43–48*).

The response of 58 species and varieties of *Medicago* to several important pathogens was tested at the Minnesota Experiment Station. *M. arborea* showed no internal or external symptoms of bacterial wilt (*Corynebacterium insidiosum*). *M. suffruticosa* and *M. dzhawakhetica* were highly resistant to *Phoma herbarum* var. *medicaginis* in both greenhouse and field tests; they were also resistant to all the foliage diseases included in the study. None of these annual species of *Medicago* tested showed notable resistance to the black-stem complex of diseases. Some of the most prevalent pathogens of *M. sativa* were able to infect practically all the *Medicago* species tested. No differences were observed among fungous isolates of the same species derived from stems and leaves of different *Medicago* species.

2029 *Kreitlow, K. W. Pierce's disease of grapes and dwarf of alfalfa. (pp. 49–50).*

The variety California Common 49, which is tolerant of the alfalfa dwarf virus, is recommended for dwarf-infested areas of California.

2030 *Tuite, J. Studies on virus diseases of alfalfa. (pp. 50–52).*

Virus isolates, obtained from lucerne populations in Indiana, are classified on the basis of their effect on tobacco, bean and cowpea.

2031 *Graham, J. Panel discussion.* Pseudoplea-Stemphylium *disease complex. (p. 53).*

Isolates of *Pseudoplea* obtained from lucerne and Ladino white clover were compared at the USDA Pasture Laboratory. The study indicated that the same species of *Pseudoplea* occurs on both hosts; there were, however, distinct differences between the isolates, suggesting the existence of two "varieties" of the pathogen.

2032 *Williams, A. S. Studies on* Stemphylium *and* Pseudoplea *from alfalfa in Virginia. (pp. 56– 57).*

Cultural studies indicated no positive relationship between *Stemphylium* and *Pseudoplea*. Wide differences were found in the sporulation and growth of a number of isolates of *Stemphylium botryosum* (*Pleospora herbarum*) growing on a medium prepared from lucerne leaves and stems, glucose and KH_2PO_4. Variations were also found in the pathogenicity of different isolates. Lucerne seedlings with varying degrees of resistance to the pathogen have been selected.

2033 *McDonald, W. C.* Pseudoplea-Stemphylium *disease complex. (pp. 58–59).*

Differences in host range, cultural characteristics and distribution which exist between *Pseudoplea* isolates from lucerne and white clover are summarized. The relationship between *P. trifolii* and *S. botryosum* (*Pleospora herbarum*) is discussed. It is pointed out that the suggestion that *S. botryosum* is the imperfect stage of *P. trifolii* has not been substantiated.

2034 *Greenshields, J. E. R. Summary report of developments in alfalfa improvement research in Canada. (pp. 60–62).*

The cooperative Saskatoon-Lethbridge breeding programme has resulted in the selection of 28 plants resistant to bacterial wilt and having good agronomic qualities. Methods of screening large populations for wilt resistance have been devised [cf. XXIX, 2745]. Lines resistant to winter crown rot have been selected at Saskatoon and Edmonton. At the Swift Current Station, progress has been made towards the development of new strains incorporating disease resistance and creeping rootedness. Studies on Mn and Al toxicity are under way at the Quebec station. A technique for estimating the degree of tolerance to Mn toxicity at the seedling stage has been developed. Wilt resistance studies are in progress at Ottawa and the University of British Columbia. At the University of Alberta diploid *M. falcata* lines and back crosses derived from *M. dzhawakhetica* x x *M. sativa* are being studied. Lines with moderate to high resistance to black stem have been developed at Saskatoon.

2035 *Pedersen, M. W. Highlights of alfalfa improvement in the western region. (pp. 62–64).*

Some of the new strains currently being tested produce high seed and forage yields and have resistance to black stem, yellow leaf blotch, downy mildew, cuckoo spit and spotted aphids. Studies on important chemical constituents of lucerne, such as saponins, estrogens and coumarins, are in progress at several laboratories in the Western states.

2036 *Adams, M. W. Highlights of research and transactions of the Central Alfalfa Improvement Conference. (pp. 65–67).*

Projects currently under way in the central United States are listed. Reference is made to the recent establishment of polycross progeny tests and synthetic nurseries in several states.

2037 *Battle, W. R. Highlights of alfalfa improvement research. (pp. 67–70).*

Progress in the development of lines resistant to the spotted alfalfa aphid is reported. Further studies on creeping-rooted lucerne have been carried out by investigators in North Carolina and New York.

2038 *Heinrichs, D. H. Winter hardiness evaluation in alfalfa. (pp. 70–75).*

[Cf. 2080].

2039 *Swanson, C. R. & Adams, M. W. Studies on the metabolism of alfalfa with respect to cold resistance. (pp. 76–78).*

The roles played by mitochondria, respiratory inhibitors and enzyme systems in the physiological control of cold resistance have been clarified. It appears that "residual respiration" exists: this respiration, under certain conditions, is unaffected by freezing.

2040 *Bula, R. J. Photoperiodic responses of alfalfa.* (*pp. 79–81*).
Both light intensity and photoperiod were found to exert strong influence on the growth of five varieties of lucerne. In contrast to reported work on other species, a long photoperiod of 20 hr. was not detrimental to growth; a greater increase in dry-weight accumulation was noted between 17 and 20-hr. photoperiods than between 14 and 17-hr. photoperiods.

2041 *Hittle, C. N., Miller, D. A. & Jackobs, J. A. Leaf-stem ratios of five varieties of alfalfa at varying stages of maturity.* (*pp. 82–88*).
Ranger was superior in leaf/stem ratio to Buffalo, Vernal, Atlantic and du Puits in 1957 trials conducted in DeKalb County, Ill. Du Puits had a significantly lower ratio than the other varieties; because its total yields were higher, however, it yielded significantly more leaves per acre than the other varieties. Du Puits was inferior to the other varieties in percentage nitrogen content of the stems, while Ranger had the lowest percentage nitrogen content in the leaves.

2042 *Howe, W. L. Entomological problems associated with breeding alfalfa for resistance to the spotted alfalfa aphid.* (*pp. 99–102*).
Details are given of the techniques used at the Nebraska Station for evaluating the resistance of lucerne clones to *Therioaphis maculata*. Two types of test are employed. The first, or mass-evaluation technique, exposes large numbers of plants to aphid attack for preliminary evaluation, while the second exposes individual plants to the insects. Nine clones which are considered resistant are listed.

2043 *Wilson, M. C. Problems in selecting alfalfa for resistance to the meadow spittlebug and potato leafhopper.* (*pp. 103–06*).
Problems involved in breeding lines with resistance to cuckoo spit (*Philaenus leucopthalmus*) and the potato leafhopper (*Empoasca fabae*) are discussed. At Purdue University, major emphasis is placed on selection for tolerance and unattractiveness to these insects, rather than on breeding immune varieties.

2044 *Standford, E. H. Report of committee for release of new varieties.* (*pp. 109–13*).
The variety Moapa is described [cf. XXVIII, 1769].

Report of the Seventeenth Alfalfa Improvement Conference held on June 27–29, 1960 at Saskatoon, Saskatchewan, Canada : Pp. 125. (Mimeographed).

In addition to the contributions summarized below, this publication includes brief reports on the proceedings of several committees.

2045 *Clement, W. M.* (*Jun.*). *Chromosome numbers and interspecific relationships in* Medicago. (*pp. 2–4a*).
A 148-entry *Medicago* collection representing 67 species and forms has been assembled at the University of Minnesota. The chromosome number and history of 102 of these entries are given. Three basic chromosome numbers were found in the annual species, $n = 7$, 8 and 16. Among the perennial species, basic numbers of $n = 8$ and $n = 16$ were found. Some of the $2n = 14$ annuals had one large pair of chromosomes. It is suggested that this might have some bearing on the origin and relationship of $n = 7$ and $n = 8$ forms.

2046 *Bolton, J. L. & Downey, R. K. The choice of parents for wide crosses in* Medicago. (*p. 5*).
The male-sterile line 20–DRC was used successfully as the pistillate parent in a cross with S–2128. Among the progeny resulting from this cross are seven triploids and one tetraploid. Interesting segregates obtained from S–2128 include the following: a speckled leaf character similar to the symptoms of a nutritional deficiency; seedlings with three and four cotyledons in a ratio of 9 normal : 7 abnormal; and white flower colour associated with a colourless seed coat.

2047 *Childers, W. R. A genetic female sterile character in* Medicago sativa *L.* (*p. 6*).
Over 85% of the ovules in a completely female-sterile plant failed to develop an embryo sac. The ovules were round in appearance while the tissues appeared as undifferentiated parenchymatous cells. In the remaining ovules, different degrees of development occurred. Post-pollination histological studies indicated that pro-embryos were formed but that abortion occurred in all cases. Microsporogenesis was regular, leading to over 90% stainable pollen which proved fertile in crosses. It was found during this study that male sterility in 20–DRC is determined by three recessive genes, inherited disomically.

2048 *Dudley, J. W. & Hanson, C. H. Certain phenotypic and genotypic correlations in alfalfa. (pp. 6–8).*
Details are given of correlations between several characters in F_2 populations derived from crosses between three creeping-rooted clones and 19 hay-type clones. Highly significant, positive correlations were found between height, spring growth and recovery; plant width and yield; leaf width and leaf length; and crown width and procumbence. These correlations were significant for three sources of variation, i.e. variation associated with hay-type parents, F_1s within crosses and plants within plots. A large number of other correlations, significant for one or two sources of variation, were also obtained.

2049 *Downey, R. K. Formation of synthetic varieties of alfalfa. (pp. 8–11).*
The value of various types of progeny, derived from 16 unrelated clones, for predicting the performance of synthetics formed from these clones, was tested. The most accurate predictions were obtained from single-cross progenies. Data from spaced and seeded tests were similar, indicating that spaced planting for evaluation of clonal material may be used with confidence. General combining ability was found to be of great importance in the material studied.

2050 *Lowe, C. C. A seed increase procedure for alfalfa. (pp. 12–15).*
Plans for utilizing maximum hybrid vigour in the commercial production of seed for limited-clone synthetics, and for the creation of a synthetic designed for the northeastern part of the USA, are proposed.

2051 *Dessureaux, L. Analysis of continuous variation in autotetraploid. (pp. 16–18).*
Size of the unifoliate leaf in lucerne seedlings appears to be polygenically controlled. The gene action involved is assumed "to be predominantly additive, dominance being partial, and nonallelic interactions being apparently absent". Theoretical aspects of polygenic inheritance in autotetraploid species are discussed.

2052 *Carnahan, H. L. Some theoretical considerations of the consequences of multiple alleles in relation to inbreeding and testing procedures in autopolyploids. (pp. 19–22)*
Topics discussed include the advantages of autopolyploids over diploids in utilizing intra-allelic interactions, and the genetic consequences and limitations of various types of progeny testing in autopolyploids.

2053 *Elling, L. J., Hanson, C. H. & Graumann, H. O. Winterkilling in diallel crosses of alfalfa. (pp. 23–26).*
The extent of autumn growth and winter kill of 14 lucerne clones and five control varieties was investigated at Rosemount, Minn. Percentage winter kill, based on performance in diallel crosses, ranged from 11·48% in Pa.53–13 to 61·38% in C902(Nev.); in the varieties it ranged from 7·7% in Narragansett to 22·5% in Atlantic. A highly significant correlation (+0·4886) was obtained between winter kill and autumn growth. However, progenies of Pa.53–13 made substantial autumn growth but suffered very little winter kill. This suggests the possibility of making some progress in the development of lines with increased autumn growth without sacrificing winter hardiness. The results of the study also showed that general combining ability is of much greater importance in a selection programme for winter survival than is specific combining ability.

2054 *Hanson, C. H.* et al. *First-year performance of variety crosses and mixtures of alfalfa at eight locations. (pp. 26–28).*
Fifteen variety crosses, 11 corresponding mixtures of the parent varieties used in the crosses and the 10 parent varieties were sown at eight locations. Preliminary data show no evidence of heterosis in the varietal crosses. In general, both crosses and mixtures yielded more than the average of the parents involved but less than the better of the two parents.

2055 *Minion, G. D., Haws, B. A. & McAllister, D. R. Studies on chalcid resistance in alfalfa. (p. 41).*
Studies in Utah indicated that Nemastan and Lahontan are less infected by the clover seed chalcid, *Bruchophagus gibbus*, than 77 other varieties and clones.

2056 *Graham, J. H. A rapid method for screening alfalfa for resistance to bacterial wilt,* Corynebacterium insidiosum. *(pp. 42–43).*
A new method has been developed at the Regional Pasture Research Laboratory, University Park, Pa. Through this method, in which leaf petioles are punctured with a glass needle carrying the bacteria, inoculated plants may be scored for wilt reaction within two or three weeks.

2057 *Hawn, E. J. Antibiosis in bacterial wilt of alfalfa. (pp. 43–44).*
Properties of an antibiotic substance, apparently formed by bacteria in the rhizosphere of lucerne varieties, are summarized. The material was

successful in destroying *Corynebacterium insidiosum in vitro*. A positive correlation was found between the amount of the antibiotic found in extracts of the dried roots of several varieties and their resistance to wilt.

2058 *Fulkerson, J. F. Further studies on variation in* Corynebacterium insidiosum. (*p. 44–45*).

Sixteen isolates of *C. insidiosum* were used to inoculate lucerne test clones. The disease reactions obtained indicated a range of virulence varying from nearly avirulent to highly virulent.

2059 *Mead, H. W. & Downey, R. K. Excised-leaf technique for inoculation of alfalfa with* Ascochyta imperfecta. (*pp. 45–47*).

The inoculation of excised leaves with spore suspensions of *A. imperfecta* gave disease ratings that did not consistently agree with ratings obtained from seedling inoculation tests and from field observations.

2060 *Heinrichs, D. H. Report on alfalfa improvement in Canada.* (*pp. 53–56*).

At the Quebec Experimental Farm, a technique has been developed for screening seedlings for tolerance to Mn and Al toxicity. The size of the unifoliate leaf was found to be a useful criterion of tolerance at a very early stage. Studies on creeping-rootedness are in progress at many stations. At Ottawa, two phages attacking *Corynebacterium insidiosum* have been isolated. An attempt is being made to transfer wilt resistance from resistant clones to Rhizoma and Flemish types by a back-cross method. At the Saskatoon station, lines showing moderate resistance to winter crown rot are being sib-inbred. Selection for winter hardiness, persistence through prolonged drought and high seed production is being emphasized at Swift Current, where other phases of the breeding programme include the development of a variety which will not cause bloat and the selection of lines combining wilt resistance and creeping-rootedness.

Lethbridge work has been concerned with the development of a winter-hardy, wilt-resistant hay type which will recover rapidly after cutting. The development of a creeping-rooted pasture type suitable for the irrigated areas of southern Alberta is also proceeding. At the University of Alberta, Ferax, a good seed setter, and tetraploid *M. falcata* are being used as the basic material in a programme designed to develop lines with improved seed set. Hexaploid *M. sativa* ($2n = 48$) has given a fair seed set. Breeding for resistance to *Pseudopeziza* and *Ascochyta* has commenced at the University of Manitoba.

2061 *Lowe, C. C. Report from the Eastern Alfalfa Improvement Conference.* (*pp. 56–57*).

A brief summary of the proceedings at this 1959 Conference is given. A report on genetic considerations involved in breeding for disease resistance concluded that "rapid recurring cycles of intermating among all known sources of resistance is more effective than selfing or back crossing in producing desirable recombinants. Severe selection in early generations and close breeding should be avoided."

2062 *Kehr, W. R. Report from the Central Alfalfa Improvement Conference.* (*pp. 57–61*).

The major lucerne improvement projects in 12 states are listed.

2063 *Eslick, R. F. Report from the Western Alfalfa Improvement Conference.* (*pp. 61–64*).

Studies on creeping lucerne are in progress in several states. Semidormant and nondormant introductions are being screened in California for year-long production and for resistance to the spotted alfalfa aphid. Investigations on resistance to various other pests and diseases are referred to briefly.

Other projects now in progress include the following: the use of heterosis for seedling and germination vigour (Colorado); specific combining ability in diallel crosses (New Mexico); the behaviour of trisomic tetraploids (California); and the development of two-clone and multiple-clone synthetics (several states).

2064 *Bubar, J. S. & Steppler, H. A. Differential expression of potash deficiency symptoms in alfalfa varieties.* (*p. 65*).

In trials held in 1959 at Macdonald College, Quebec, French varieties showed less severe symptoms of potassium deficiency than did North American varieties. Among the latter, symptoms were least acute on Rambler and Grimm.

2065 *Dessureaux, L. Differential response of alfalfa to Al toxicity.* (*pp. 65–67*).

A comparison of selfed progenies from tolerant and susceptible phenotypes of four varieties indicated that visual selection for tolerance to Al toxicity in the seedling stage is effective. The data showed also that enough variability exists within varieties to warrant a selection programme for tolerance to Al toxicity.

2066 *Smith, D. Association of certain seed characteristics with varietal performance. (pp. 67–68).*

Plants of Vernal lucerne derived from seed of crosses among tall, upright plants were uniformly tall and sustained considerable winter injury at Madison, Wis., while plants from crosses among short, spreading plants were uniformly short and suffered very little winter injury. Blue-flowered plants of the same variety suffered more injury than plants that failed to flower or had green flowers. No marked associations between seed type and winter survival were observed.

2067 *Kempton, A. & Heinrichs, D. H. Varietal differences in rootlet formation and nodulation of alfalfa seedlings. (pp. 73–76).*

Three strains of *Rhizobium* and 14 varieties of lucerne were used in a study of lateral root growth and nodule formation. It appears that the number of nodules formed is a function of the plant variety rather than the bacterial strain. Although there were differences between varieties in the rate of lateral root formation, nodule formation did not appear to be related to this rate.

2068 *Carter, J. F. Forage and protein production of nine alfalfa varieties with and without phosphorus fertilization and cut 2, 3, or 4 times annually, 1953–58. (p. 77).*

In trials held in 1954–1958 at Fargo, N. Dak., Ladak and Vernal were superior to seven other varieties in both forage and protein yield. Du Puits and Grimm were severely damaged by bacterial wilt, particularly when a 3-cut or 4-cut system of management was used.

2069 *Pedersen, M. W. Seed and hay productivity tests of alfalfa varieties and strains. (pp. 83–90).*

Tabulated information is provided on the performance of 33 varieties at Logan, Utah, and 16 of the same varieties at Wapato, Wash. Highest seed yields at Logan in both 1958 and 1959 were obtained from Utah Synthetic C. This variety also yielded well at Wapato. Various correlations and interactions are presented and discussed.

2070 *Jackobs, J. A., Graffis, D. W. & Hittle, C. N. The response of five alfalfa varieties under seven hay management systems in northern Illinois. (pp. 92–99).*

Du Puits outyielded Ranger, Buffalo, Vernal and Atlantic under all management systems during the first two years of this trial. In the third year Atlantic and du Puits, both of which are wilt susceptible, were outyielded by the other three (wilt-resistant) varieties.

2071 *Clark, K. W. Persistence of Rambler alfalfa under grazing. (pp. 99–106).*

Rambler, Siberian and Sc3513 showed satisfactory persistence in trials at Swift Current, Sask. Winter injury was severe in Ladak, Rhizoma, Vernal and Nomad.

2072 LILIENFELD, F. A.
Investigations in *Medicago laciniata* (L.) Mill., I.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 1–10.

A sample of *M. laciniata* consisted of two leaf types, one typical of the genus and the other, the laciniate type, with the younger leaves notched though the later leaves are normal. The laciniate type is determined by a single dominant gene.

2073 CHILDERS, W. R.
What about hybrid alfalfa ?
Forage Notes, Ottawa 1960 : **6** : No. **3** : 14–16.

With reference to investigations in Canada, problems of the development and commercial production of F_1 hybrids are considered. A source (20DRC) of complete genetic male sterility is available [cf. 582], but further search for cytoplasmic male sterility is necessary, since use of this type would contribute to a reduction in the cost of maintaining male-sterile lines. Heritable complete female sterility has recently been discovered at the Genetics and Plant Breeding Institute, Ottawa. Female-sterile plants produce pollen in abundance and could be grown in alternate rows with male-sterile plants for F_1 seed production. The two types have been crossed with desirable bacterial-wilt resistant lines, to incorporate male and female sterility in commercially acceptable stocks. Several other problems requiring attention are mentioned, e.g. whether use of bees as pollinators would result in sufficient seed production for commercial purposes, the number of years a hybrid breeding block could be kept down and methods of control of volunteer seedlings.

2074 LOWE, C. C., MURPHY, R. P., FORTMANN, H. R. & BATTLE, W. R.
Variation in polycross progeny performance in alfalfa observed under regional testing in the Northeast.
Bull. Cornell agric. Exp. Sta. 1960 : No. 953 : Pp. 32.

Tabulated information obtained from a series of polycross trials conducted at four centres during 1952–56 to determine the range of adaptation to north-eastern conditions of 73 lucerne clones selected for their superiority in one or more areas within the region is presented. Some notes on disease resistance and growth habit are also included. The data indicate that for a given set of progenies the test location and the length of the testing period can markedly alter the number of progenies which would be included in some predetermined fraction of the yield range. Trials of less than 3 years' duration are considered to be unreliable for evaluating yield potential although little difference was found between 3rd and 5th-year ratings. The progeny x location interactions recorded are thought to be due at least in part to differences in the adaptation ranges of the progenies. The nine best clones have been polycrossed for testing in more extensive trials. The genetic nature of polycross progenies, the expected variation, and evaluation procedures are discussed.

2075 Tabačkova, Ju. N.
(Using labelled atoms for studying the changes in various properties of lucerne during the training process).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1959 : No. 9 : 24–26. [Russian].

Details are given of differences in the intake of P^{32} and Ca^{45} on neutral and acid soils between (1) an ordinary variety of lucerne and (2) a hybrid form which had been previously trained for tolerance to soil acidity at the Williams Institute.

2076 Ilchievici, C. *et al.*
Raionarea provenienţelor locale de lucernă evidenţiate la Staţiunile zonale I.C.A.R. în culturi comparative. **(Regional standardization of local provenance types of lucerne from evidence provided by the zonal stations of the Rumanian Institute for Agronomic Research in comparative trials).**
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 193–204.

Trials of local Rumanian and introduced lucerne populations are reported, data being provided on the yield during each of three years' growth. Populations recommended for the various regions of Rumania are noted.

2077 Panella, A. & Bingefors, S.
Sugli effetti dell'incrocio naturale nella produzione di seme di medica svedese in Italia. **(The effects of natural crossing in seed production of Swedish lucerne in Italy).**
Sementi elette 1960 : **6** : No. 4 : 10–12.

Some 1000 plants each of the Swedish cultivar Tuna and the Italian Nostrale umbra [Umbrian Local] were planted in alternate rows at Perugia in central Italy, the seed from each being gathered separately, and sown, both in Sweden and Italy, in a randomized block experiment together with seed of the two varieties grown pure. At Ultuna in Sweden the forage yield was highest from pure seed of Tuna, that from the others being: Tuna (x Nostrale) 96%; Nostrale (x Tuna) 83%; and Nostrale 66%. In view of the relatively small reduction in yield from the Tuna seed crossed with Nostrale, it is not considered that excessive precautions to prevent outcrossing are justifiable except in the case of élite stocks.

2078 Miller, J. W.
Sterility in alfalfa.
Diss. Abstr. 1960 : **21** : LC Card Mic 60–2261 : p. 29. (Abst.).

Seed setting, together with flower size, pod shape and growth habit, was studied in 38 species of *Medicago*. Nine species with relatively large flowers, uncoiled or loosely coiled spineless pods and perennial habit were self sterile. One self-fertile species, *M. suffruticosa*, had the characteristics associated with self sterility. The remaining 28 species were self-fertile annuals with variable flower size and loosely or tightly coiled pods with or without spines. All the self-fertile species were self-tripping, with the exception of *M. suffruticosa*. "Evidence was obtained that self sterility in diploid *Medicago* species was the result of the combined effects of inhibition of pollen tube growth prior to fertilization and abortion following fertilization—an observation in accord with earlier data for tetraploid *Medicago*. Self-incompatibility in the diploid species appeared to be physiologically independent of post-fertilization failure. It was concluded that the incompatibility system acting prior to fertilization could not be a single gene system—neither gametophytic nor sporophytic. Rather, it seemed that this was a two- or multi-gene system, conceivably a duplicated S locus—the gametophytic system of action being more probable than the sporophytic one."

2079 Konstantinova, A. M. & Tabačkova, Ju. N.
(Breeding lucerne forms tolerant of acidity).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 38–41. [Russian].

K19, K20 and Severnaja Gibridnaja K69 [Northern Hybrid K69], characterized by high regular hay yields on acid soils, were bred at the Williams Institute. The method consisted of raising hybrid plants on soils with different pH values and then cross pollinating them. All the above varieties are more productive of hay than the standard variety Severnaja Gibridnaja 69 [Northern Hybrid 69] on neutral and especially acid soils.

2080 Heinrichs, D. H., Troelsen, J. E. & Clark, K. W.
Winter hardiness evaluation in alfalfa.
Canad. J. Pl. Sci. 1960 : **40** : 638–44.

In investigations at the Experimental Farm, Swift Current, Sask., winter injury was found to be inversely proportional to the hexosan content of the roots in the autumn. Growth recovery in the autumn was also related to winter injury, the faster the recovery, the greater being the winter injury of a variety. Rapid recovery of growth and hexosan content were closely associated. Root development in the seedling year was slower in hardy varieties than in less hardy ones. It is concluded that a combination of data on recovery and hexosan content could be used in screening breeding material for hardiness. Thus, selections made in the F_2 of crosses between hardy and non-hardy stocks could be analysed for hexosan content when dug up in the autumn. The roots could be used for this purpose and stem cuttings for propagation.

2081 Smith, O. F. & Peaden, R. N.
A method of testing alfalfa plants for resistance to the pea aphid.
Agron. J. 1960 : **52** : 609–10.

A description is given of a method of testing caged plants for resistance to pea aphid (*Macrosiphum pisi*), in use at the Agricultural Experiment Station, Reno, Nev. Genotypes found to possess a high degree of resistance are being utilized to discover whether it is possible to develop a resistant commercial variety. Resistant clones are being assembled in various two-clone combinations and in synthetics. The progenies of these combinations will be tested for both resistance and forage yield.

2082 Ortman, E. E., Sorensen, E. L., Painter, R. H., Harvey, T. L. & Hackerott, H. L.
Selection and evaluation of pea aphid - resistant alfalfa plants.
J. econ. Ent. 1960 : **56** : 881–87.

In investigations at the Kansas Agricultural Experiment Station, several techniques were found to be satisfactory for identifying individual plants resistant to pea aphid (*Macrosiphum pisi*) within varieties and for evaluating progenies derived from resistant selections. Selection of vigorous surviving seedlings after infestation with large aphid populations at the early seedling (cotyledon) stage is considered to be a method well adapted to screening large numbers of plants in a relatively small space under greenhouse conditions. Evaluation for resistance was also accomplished on the basis of (1) differential stunting at various stages of growth, with infestation at the early and late seedling stages, or (2) colonization when the plants were infested at the late seedling stage or when mature. The resistance of selected plants was verified by several methods, including tests of antibiosis as indicated by adult survival and fecundity over a 7-day period, aphid numbers per plant in the field, and seedling progeny tests involving both survival and stunting. Although some of the techniques described were applicable in the field, the advantage of screening in the seedling stage under greenhouse conditions is emphasized. The agreement found between data obtained by using the various techniques demonstrated the value of each criterion in assessing resistance. The advantage of utilizing different methods in breeding lies in the fact that selection pressure may be exerted for all three bases of resistance, viz. preference, antibiosis and tolerance. Seedling tests for mortality and stunting measure the sum of effects of these three factors.

2083 **Culver alfalfa resists spittlebug.**
Crops & Soils 1960 : **13** : 20–21.

The lucerne Culver is the first variety with resistance to cuckoo spit (*Philaenus leucophthalmus*) to become available for the midwest of the USA. It also has some resistance to *Empoasca fabae*, *Therioaphis maculata*, bacterial wilt and leaf-spot diseases. With normal infestation by cuckoo spit, Culver may be expected to perform well without use of insecticides.

2084 McMurtry, J. A. & Stanford, E. H.
Observations of feeding habits of the spotted alfalfa aphid on resistant and susceptible alfalfa plants.
J. econ. Ent. 1960 : **53** : 714–17.

Aphids (*Therioaphis maculata*) soon assumed a feeding position when placed on either resistant (clone C–84) or susceptible plants (Caliverde). On the former, however, they became restless in 1–4 hr. and eventually died or left the plants. Little or no honeydew was produced on resistant individuals, whereas profuse honeydew production occurred on susceptible plants. Survival of aphids placed first on resistant plants and later transferred to Caliverde was as good as that of aphids transferred from susceptible plants. The absence of a residual toxic effect was therefore indicated. Aphids confined to highly resistant plants died at nearly the same rate as those confined with no source of food. The phloem was the chief feeding site. It was however observed that the setal tubes entered the phloem less frequently in resistant than in susceptible plants, suggesting that the capacity of the aphids to locate the phloem was interfered with in resistant lucerne. The resistance of C–84 could not however be completely explained on this basis, since it appeared that even those aphids reaching the phloem in this variety were unable to feed normally and survive.

2085 Reynolds, H. W. & O'Bannon, J. H.
Reaction of sixteen varieties of alfalfa to two species of root-knot nematodes.
Plant Dis. Reptr. 1960 : **44** : 441–43.

Sixteen lucerne varieties were tested for resistance to *Meloidogyne javanica javanica* and *M. incognita acrita*. The former was the more damaging to most of the varieties. African, Moapa and India are highly resistant to both nematode species; Moapa has the additional advantage of being resistant to *Therioaphis maculata*.

2086 Müller, G.
Untersuchungen über das Pollenschlauchwachstum bei verschiedenen *Trifolium*-Artkreuzungen. (**Investigations on the pollen tube growth in different *Trifolium* interspecific crosses**).
Züchter 1960 : **30** : 28–30.

Pollen tube growth in 15 crosses involving five species was studied. In some crosses such as 2*n* *T. alexandrinum* x 2*n* *T. pratense* and 2*n* *T. hybridum* x 2*n* *T. pratense* the pollen tube did not grow into the style. In other crosses some growth was observed; for example in 2*n* *T. pratense* x 2*n* *T. hybridum* the pollen tube did not grow through more than two-thirds of the style whilst in 2*n* *T. alexandrinum* x 2*n* *T. resupinatum* the pollen tube reached the end of the style in some cases and fertilization was possible. Crosses involving polyploids were no more successful than corresponding crosses between diploids. Irregular growth of pollen in the style appears to be a primary cause of sterility in interspecific crosses.

2087 Pavlov, A. & Savatti, M.
Măsuri importante de sporire a productiei trifoiului roșu în Transilvania. (**Important measures for increasing the yield of red clover in Transylvania**).
Probl. Agric., București 1960 : **12** : No. **6** : 38–45.

Some data are included on yield improvements obtained from five red clover populations bred at the Cluj research station.

2088 Koblet, R. & Nüesch, B.
Physiologische und genetische Studien am schweizerischen Mattenklee. (**Physiological and genetic studies on Swiss alpine clover**).
Schweiz. landw. Mh. 1960 : **38** : 401–07.

The race of clover described is thought to have originated in the alpine meadows by unconscious selection from red clovers introduced in the 18th century from the Netherlands, possibly combined with crossing with local wild red clover. Flowering in alpine clover is determined by photoperiod whereas the local wild clover is day-neutral. Races from high altitudes have greater persistency, though all are inferior in this respect to the wild clovers. There was no inverse correlation between persistency and early vigour. The alpine clover is more frost resistant than red clovers from central Europe but less than those from Scandinavia; it has a stronger root development than common red clovers and a higher dry-matter content.

Most of the above characteristics proved to be hereditary, its persistency being dominant. Breeding work aimed at combining this persistency with earlier flowering and increased yield is contemplated.

2089 Nüesch, B. E.
Untersuchungen an Rotklee-Populationen im Hinblick auf die züchterische Verbesserung des Mattenklees. (**Investigations on red clover populations with a view to improving the alpine clover by breeding**).
Landw. Jb. Schweiz 1960 : **74** : 305–407.

The Swiss alpine clover is thought to have originated in the high alpine meadows in the vicinity of Bern and is distinguished by great longevity. Many land races exist and form the subject of this dissertation. Populations from different localities were grown in the neighbourhood of Zürich together with 12 samples of red clover from other countries.

Cultivars of northern provenance flowered later than those from more southerly latitudes and differences were observed between populations of alpine clover from different localities; those from the highest altitudes were the first to flower but all flowered earlier than the cultivars. Differences in flowering time were observed between different plants within the populations. The Swiss wild clovers of the lowlands were earlier in flowering but in the high altitude they were later and the difference between the wild and alpine clovers was relatively slight; many of the wild clovers formed flowers again after the first cut; the wild clovers are more or less day-neutral whereas flowering in the alpine clover is strictly controlled by photoperiod. Wild clover hybrids in populations of alpine clover can be distinguished by their early flowering, since early flowering is dominant.

Stem length was greater in the later varieties and wild clovers from high altitudes. Within the alpine clover, populations from high altitudes were the shortest but there was no correlation with flowering time. Short stem was generally dominant, though rather contradictory results were obtained in crosses between alpine and wild clovers.

There was a correlation of $r = 0{\cdot}971$ between time of flowering and number of internodes, late cultivars having the largest internode number; little difference was observed in internode length. The internode number was low in the alpine clover and in the wild clovers of the lowlands, increasing with increasing altitude up to 1900 m. Low internode number was dominant in crosses between alpine clover and cultivars. High positive correlations were found between weight of stem per plant and number of leaves and number of stems. In pubescence the alpine clover was intermediate between the northern cultivars with dense upright pubescence and the southern with appressed hairs, though wide differences were found between populations. In the wild clovers the differences were still more pronounced.

Though the leaves of the alpine clover were larger than those of the wild, the leaf shape was similar. Some 2% of the plants in the wild clover populations were without leaf mark. The higher N content of the leaves as opposed to stems was confirmed, the mean figures being 4·27% of dry weight and 1·52% respectively. Populations of alpine and wild clover were found to differ in proportion of stem to leaf. The wild clovers from higher altitudes had a lower proportion of leaves than those from the lower, both being lower than the alpine clover. The proportion of flowers was greatest in the wild clovers. Differences between families were detected in percentage of stem, leaf and flower. Stem percentage showed a higher correlation with total yield than leaf percentage, particularly in wild clovers; in the alpine clover the correlation was somewhat lower, which indicates the possibility of selecting lines with improved yield and leafiness. The wild clovers, though having a high stem percentage, have stems with a relatively high protein content, owing to the stems being less woody, and are therefore regarded as having some value for breeding.

The alpine clover was more upright in habit than the wild clovers, all of which were more or less recumbent, particularly those of higher altitudes. Differences in habit were also observed between different cultivars, later cultivars being more procumbent than early. In crosses between different types the procumbent habit was dominant.

Yield tests showed that late cultivars gave the highest yield of green matter, the highest being Resistenta, with a total yield of 2950 g. per plant, and the tetraploid Weibull 1224 with 3900 g. Total yields from the alpine clover were not so high but it could be cut more frequently than the late cultivars and in their second year some of them produced 11·0 g. per day, which gave a yield equal to that of the late cultivars; the best populations yielded twice as much as the poorest. The yields of the wild clovers were 50–80% of those of the alpine clover, those from higher altitudes having the best yields in the first cut; thus one plant from Innetal gave a yield of 1850 g., all in a single cut. Hybrids between alpine and wild clover were roughly intermediate in total yield but were earlier in development. A number of hybrids between alpine clover and late cultivars gave unusually good yields, those from Resistenta being 148% higher than the alpine-clover parent in total yield. The hybrids resemble the alpine clover in giving a regular yield throughout the growing season. No strong correlation was found between total yield and flowering time of individual plants within a population. Though some tendency was found for longevity to be less in plants that attained their maximum yield early, many plants were found which did this and maintained high yields over three years and more. The percentage survival after the severe winter of 1955–56 was as high or higher in many alpine clovers than in late cultivars from other countries; the survival varied in populations of alpine clover from different areas from 0 to 46%, being highest in those from high altitudes; survival was still better in the wild clovers, differences being again observed between populations and between families. Persistency percentage was not correlated with rate of development or flowering time. On account of its persistency the alpine clover can still be classed as *Trifolium pratense* var. *sativum* subvar. *perenne,* though it is becoming less persistent on account of cross pollination with introduced cultivars and of relaxed natural selection due to changed agricultural practices. Its persistency and other attributes have probably been derived from natural crossing with local wild clovers.

Later varieties were generally, though not invariably, more frost resistant: the alpine clover 'Leisi' and the cultivars Kuhn, Øtofte and Essi combined frost resistance with relative earliness whereas English varieties were less hardy than would be expected from their lateness. Frost-resistant populations of wild clover were found at both high and low altitudes but in general the wild clovers were less resistant than the alpine. There was no correlation between flowering time and hardiness in either alpine or wild clovers. Resistance to artificial infection with *Sclerotinia trifoliorum* in the alpine clover was greater than in wild clover and though not high, it was roughly equal to that of resistant cultivars such as Resistenta; a slight improvement was effected after two generations of selection. Several other fungous diseases of red clover are mentioned.

Studies on flower colour showed that white flowers appear occasionally in the alpine clover, the frequency being only 0·016%. They breed true. Variations in length of corolla tube were found between populations of both wild and alpine clover; the values are generally lower in the latter and it is thought that the length could be still further reduced by selection.

Artificial selfing gave a seed set of 0·23% in wild and 0·038% in alpine clover. Seedlings from selfing showed a variety of chlorophyll and other defects; the degree of pseudofertility was increased by intercrossing between seedlings from selfing. In artificial cross pollinations in the greenhouse a mean seed set of 68% was obtained in alpine clover and over half the combinations gave sets of over 70%. Certain plants showed a pronounced tendency towards the production of two-seeded fruits, a tendency still more marked in the wild clovers. Late forms produced larger quantities of seed than early. The mean germination capacity of the seeds was 62·1% in alpine and 44·2% in wild clover, the latter having a higher proportion of hard seeds. Plants belonging to families bearing predominantly hard and soft seeds respectively, when crossed in various combinations, gave a regression coefficient of $b = 0{\cdot}965$ between the values of parents and offspring, which is taken as indicating that hard seeds are controlled by a number of genes. The proportion of hard seeds was not strongly correlated with altitude or with yield but plants from hard seeds were generally more persistent. The 1000-seed weight was higher in alpine than in wild clover, the difference being statistically significant in some cases and not in others; there were also differences between populations. Size of seed from cross pollinations was influenced mainly by the seed parent. Populations of alpine clover from high altitudes had smaller seeds than those from lower but no such correlation was found in wild clovers. There was a positive correlation of seed size with yielding ability but not with germination capacity or persistency. Characteristic differences in shape of seed were detected between individual plants. The heritability parameter h^2 for most of the characters studied was below 0·5 and it is concluded that family selection will be the most effective method of breeding combined with the polycross method to exploit general combining ability. Single-plant selections, made on the basis of longevity and high average yield, are being crossed in pairs and the progenies are being planted in a polycross nursery with 10 replications, each with 5 plants. Selection of the best combinations will be made after two winters have elapsed. Group crossing is also to be applied, with the object of improving a wider range of characters.

2090 Larpes, G.
Tetraploid rödklöver. (**Tetraploid red clover**).
Tidskr. Lantm. Andelsfolk, Helsingfors 1960 : No. 10 : 225–26.

In Finnish tests, the Swedish tetraploid Ulva [cf. XXVIII, 4336] has outyielded Tammisto by 20% and is more resistant to clover rot; seed set has been satisfactory in good bumble-bee years. The Finnish tetraploid Jo TPA has also given good fodder yields.

2091 Wilcoxson, R. D. & Peterson, A. G.
Resistance of Dollard red clover to the pea aphid, *Macrosiphum pisi*.
J. econ. Ent. 1960 : **53** : 863–65.

Most plants of Dollard were much more resistant to the above aphid than those of Wegener in greenhouse tests at the Minnesota Agricultural Experiment Station. Resistance in Dollard was due to nonpreference and antibiosis. The incidence of virus was considerably lower in Dollard than Wegener under field conditions, but when the two varieties were mechanically inoculated with the mosaic and pea-stunt viruses they were equal in susceptibility. Breeding for aphid resistance may offer a more successful means of virus control than breeding for virus resistance.

2092 Diachun, S. & Henson, L.
Virus-resistant red clover plants look promising.
Crops & Soils 1960 : **13** : No. 2 : p. 19.

Plants resistant to at least one strain of bean yellow mosaic virus have been found at the University of Kentucky. Clones developed from 3 of these plants offer promise as breeding stocks.

2093 Crowder, L. V.
The response of white clover varieties grown at high elevations in Colombia.
Agron. J. 1960 : **52** : 608–09.

A report is given on observations on many introduced varieties, representing white Dutch, intermediate, Ladino and polyploid types, studied in plots and as single plants in several localities at high altitudes in Colombia. A wide array of plant types was found within most varieties. The intermediate varieties flowered much more profusely than the other types.

2094 Davies, D. R. & Wall, E. T.
Induced mutations at the V^{by} locus of *Trifolium repens*. I. Effects of acute, chronic and fractionated doses of gamma radiation on induction of somatic mutations.
Heredity 1960 : **15** : 1–15.

Two clones derived from sister plants and heterozygous for the leaf-marking alleles V^{by} and *v* were irradiated [cf. XXX, 1664]. Mutant phenotypes were characterized by (1) loss of the complete mark, (2) loss of the white V only, (3) loss of the yellow tip only, (4) reduction of the white V to spots or (5) reduction in the intensity of the white V. At the lowest dose (500 rads) and highest (4000 rads), the percentages of leaves with mutations were 0·22 and 3·97, respectively. As stated in the earlier paper, the separation of the two phenotypic characteristics of V^{by} in (2) and (3) is regarded as evidence of the structural complexity of the locus. Mutants of types (2), (4) and (5) are not known to occur naturally. The dose-response relationship for total percentages of mutant leaves could be fitted either to quadratic or linear functions. In all cases, fractionated and chronic doses induced considerably lower frequencies of mutations than acute. This finding may be partly attributed to (*a*) the multihit nature of some of the mutational events scored, (*b*) an increase in the proportion of resting and hence more resistant cells in tissues exposed to an initial fraction of radiation, and (*c*) a changed sensitivity of irradiated cells. A pronounced and consistent effect of genotype on mutagenic sensitivity was detected, although the clones had been derived from full sibs.

2095 Hawkins, R. P.
Botanical characters for the classification and identification of varieties of white clover.
J. nat. Inst. agric. Bot. 1959 : **8** : 675–82.

Time of flowering, leaf size and shape, thickness of stolon and petiole and cyanophoric reaction were recorded for varieties studied under standard conditions during 1952–58 at Cambridge, England. The diagnostic value of these characters is discussed and a scheme of classification given for the varieties Dutch, Kent Wild, Kersey, Ladino, New Zealand, S100 and S184.

2096 Wolter, J.
Badania nad krajowymi populacjami koniczyny białej (*Trifolium repens* L.). [**Investigations on native populations of white clover (*T. repens* L.)**].
Ann. Univ. M. Curie-Skłodowska : Sect. E. 1958 : **13** : 297–325.

Leaf and stem characters, reaction to sowing date and vernalization, response to inoculation with *Rhizobium trifolii* and hardiness were studied in 14 Polish populations and one from the Netherlands. The populations were variable but, with the exception of the introduced variety, which was less hardy than the Polish material, did not differ significantly from each other.

2097 Grylls, N. E. & Peak, J. W.
Varietal reaction and genetic resistance of subterranean clover (*Trifolium subterraneum* L.) to subterranean clover stunt virus infection.
Aust. J. agric. Res. 1960 : **11** : 723–33.

Nearly 400 Australian and introduced varieties and strains were screened in the greenhouse for resistance to clover stunt, inoculation being effected by means of aphids (*Aphis craccivora*) transferred from field-infected plants. The only entries with a high degree of resistance were the Australian varieties Tallarook, Hill's Small and Bass B. The mean of infection in a selected group of F_2s from crosses of Tallarook with susceptible parents was slightly above the midparental value. Resistance was therefore inherited with slight or no dominance. It was not possible to discriminate between determination by one, few or many genes. In selected groups of the F_4s and in selected second and third-generation back crosses to Tallarook, resistance equal to that of Tallarook was found. Correlation between resistance in the greenhouse and field was in general fairly good. A number of selections from the crosses involving Tallarook combine resistance with desirable agronomic characters. The value of Hill's Small and Bass B as parents is now being explored.

2098 LIMBERG, P. & ENAYAT, R.
Der Einfluss klimatischer Wachstumsfaktoren auf Entwicklung und Ertragsleistung verschiedener Herkünfte von *Trifolium alexandrinum* L. **(The influence of climatic growth factors on the development and yield of *T. alexandrinum* L. from different sources).**
Z. Acker- u. PflBau. 1960 : **111** : 116–50.

The results are reported of pot and field experiments conducted at Giessen and Rauisch-Holzhausen. *T. alexandrinum* is a quantitatively reacting long-day plant but the effect after 15 hr. daylight is very slight. Of the types tested, the Egyptian clovers Fahli and Miscavi were least dependent on day length and the Italian varieties showed the greatest effect. The single-cut variety Fahli was less productive than the multicut varieties and is not considered to be worth cultivating. Miscavi proved suitable for early summer sowing and the Italian clovers for spring sowing. The Portuguese types showed the best drought resistance.

2099 JOELSSON, G.
En metod att på groddplantstadiet igenkänna utländska och svenska vickertyper samt dessas lämplighet för odling i Sverige. **(A method of identifying foreign and Swedish vetch types and their suitability for cultivation in Sweden at the seedling stage).**
Medd. Frökontrollanst., Stockh. 1960 : No. 35 : 65–76.

Of sixty samples of vetch tested for green fodder production under Swedish conditions, those from Sweden, Poland and North America were best. The remainder fell into three groups with progressively lower yields. The different types can be identified on the basis of leaf form, leaflet number and internode length in 14-day-old plants raised in artificial light.

2100 SCHAEFFER, G. W., HASKINS, F. A. & GORZ, H. J.
Genetic control of β-glucosidase activity in *Melilotus alba*.
Genetics 1960 : **45** : p. 1010. (Abst.).

Four essentially isogenic lines with the genotypes *CuCu BB*, *CuCu bb*, *cucu BB* and *cucu bb* were studied; information has already been given on the free and bound coumarin contents associated with these genotypes [cf. XXX, 1274]. Preparations of leaf tissue from *BB* plants were high in β-glucosidase activity but comparable preparations from *bb* plants had negligible activity. In preparations of various tissues from *BB* plants, level of β-glucosidase activity was closely associated with content of free coumarin. It is postulated that free coumarin is formed through the action of β-glucosidase on bound coumarin and that *b* influences coumarin metabolism through its effect on β-glucosidase.

2101 SHASTRY, S. V. S., SMITH, W. K. & COOPER, D. C.
Chromosome differentiation in several species of *Melilotus*.
Amer. J. Bot. 1960 : **47** : 613–21.

Meiosis was studied in the following: two species of sect. *Eumelilotus* (*M. alba* and *M. officinalis*); two of sect. *Micromelilotus* (*M. messanensis* and *M. segetalis*); F_1 hybrids of *M. officinalis* x *M. alba* and *M. messanensis* x *M. segetalis*; autotetraploids of *M. alba* and *M. officinalis*; and allotetraploid *M. alba* x *M. officinalis*. The species and F_1s all had $2n = 16$. *M. alba* and *M. officinalis* are completely isolated because of seed failure after cross pollination. F_1 *M. officinalis* x *M. alba*, obtained elsewhere by embryo culture, was intermediate between the parents in certain morphological characters and had about 75% pollen fertility, whereas the parents approached complete fertility. Pachytene examination revealed no evidence of gross structural differences between the chromosomes of the two species; disturbances causing the reduced fertility occurred at later stages of meiosis. The two autotetraploids and allotetraploids had about 50% pollen sterility and were characterized by similar frequencies of associations, the numbers of quadrivalents most frequently observed being one and two. *M.*

messanensis and *M. segetalis* were cross compatible but the F_1 hybrid had 98% pollen sterility. Interspecific differences in chromosome structure were evident at pachytene, although bivalents were regularly formed at metaphase I. Irregular distribution of the chromosomes at later stages was responsible for the sterility. It is concluded that genomic differentiation is not necessarily a prerequisite of noncrossability.

2102 WINKLER, H. & LUSTIG, H.
Odlingsförsök med sötlupiner utförda vid Statens Försöksgård Flahult. (**Cultivation trials with sweet lupins, carried out at the State Experimental Station, Flahult**).
Medd. Jordbruksförs. 1960 : No. 110 : Pp. 21.

Part I of this paper gives details of yields of green and dry matter, dry-matter content, length of time from sowing to flowering and plant height for three yellow and two blue varieties. The Danish yellow lupin Neven was highest in yields of both green and dry matter.

2103 GLADSTONES, J. S.
A study of the genetics and agronomy of the genus *Lupinus* with particular reference to varieties of potential value in W.A.
J. Aust. Inst. agric. Sci. 1960 : **26** : 292–93.

The taxonomy of Australian lupins was studied by morphological comparison, chromosome counts and attempted interspecific crossing. It was shown that the West Australian blue lupin is probably *L. digitatus* Forsk. rather than *L. pilosus* or *L. varius*. The development of testa impermeability in *L. digitatus* was found to be closely dependent on seed moisture content. Among the mutations recovered when air-dry seeds of the same species were subjected to X irradiation, was an early-flowering line of possible value.

2104 BRANDENBURG, N. G.
Self- and cross-fertility in birdsfoot trefoil, *Lotus corniculatus* L.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1276 : p. 3928. (Abst.).

Seven F_1 crosses among five clones varying in degree of self fertility showed partial or no dominance of self sterility. Deviations of F_1 means from biparental means ranged from −0·2 to 19·3 for percentage pod set. Fourteen F_1 plants from a cross between two self-incompatible parents were evaluated for self incompatibility, intercrossed in all possible combinations and reciprocally back crossed with both parents. All F_1 individuals were self incompatible. Neither F_1 intercrosses nor reciprocal back crosses exhibited cross incompatibilities. F_1 plants from four crosses underwent a small but significant decrease in seed set when sibbed, as compared with outcrossing, the respective average decreases for seeds per pod, percentage pod set and seeds per flower being 5·1, 5·2 and 9·4. Inbreeding resulted in a much greater reduction in self fertility than in plant vigour. Rate of pod development was determined after selfing and outcrossing S_1 plants. Practically all abortion occurred prior to the seventh day after pollination. By the fifth day, all pods resulting from crossing had made noticeable longitudinal development, but a few pods from selfing were not yet evident. Pollinations in the spring were more successful than those made during midwinter. A toothpick technique was more efficient for selfing than manual manipulation.

2105 FORD, R. E.
A report on the testing of Lotus species for resistance to *Stemphylium* leafspot and stem canker.
Plant Dis. Reptr. 1960 : **44** : 276–80.

Forty-three *Lotus* species and 18 strains and varieties of *L. corniculatus* were tested for reaction to *S. loti*. Resistance was most common in the *L. corniculatus* material but *L. tenuis* and *L. major* also had low disease ratings.

2106 SUETSUGU, I., ITO, I., MIYAMOTO, M., YAMASAKI, S. & TSUCHIYA, S.
(**Experiments on the degree of natural crossing in *Astragalus sinicus***).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 69–74. [Japanese].

Mixed plantings involving red-flowered and white-flowered varieties and a variety in which flowering was not dependent on low temperature showed that the crossing percentage (entomophilous) was between 80 and 90%. Data are also provided on the relation between crossing percentage and distance between the potential parents.

2107 FRAHM-LELIVELD, J. A.
Observations on chromosomes in the genus *Indigofera* L.
Acta bot. neerl. 1960 : **9** : 286–93.

Root-tip chromosome counts were made in forty samples pertaining to 21 species, collected mainly from West Africa. All the endemic African species had $2n = 16$ with the exception of *I. microcalyx*, which had $2n = 32$; other tetraploid species were Afro-Asiatic, American, Asiatic or pantropical. Three hexaploids ($2n = 48$) were of Himalayan origin. The individual chromosomes could not be identified in the various species, but clear differences in dimensions were apparent in some cases and there were definite differences in the total lengths of the chromosome complements.

ROOTS AND TUBERS

2108 Savitsky, H.
Viable diploid, triploid and tetraploid hybrids between *Beta vulgaris* and species of the section Patellares.
J. Amer. Soc. Sug. Beet Tech. 1960 : **11** : 215–35.

Studies on hybridization between a wide range of diploid and tetraploid races of *B. vulgaris*, as female parents, and the nematode-resistant species *B. procumbens* ($2n$), *B. webbiana* ($2n$) and *B. patellaris* ($4n$) are reported. Although a large number of diploid, triploid and tetraploid hybrid seedlings were obtained, the majority of these were inviable, dying 3–5 weeks after germination. Viability of hybrids varied at different ploidy levels. Of 16 diploid matings, only 1 mating, involving Lyon chard x *B. webbiana*, yielded viable progeny. Out of a total of 27 triploid matings, progenies of low viability were obtained only from hybrid combinations of tetraploid chard with certain lines of *B. procumbens* and *B. webbiana*. Tetraploid matings were most successful, as out of 18 hybrid progenies, six were viable and a further two were of low viability. The progenies involved were derived from crosses of certain lines of tetraploid sugar beet and chard with *B. patellaris*. All the hybrids had 36 chromosomes, with the exception of two plants which were hypotetraploids with 34 and 35 chromosomes.

Although parental plants involved in hybridization were always male fertile, F_1 hybrids between *B. vulgaris* and all three *Patellares* species developed male sterility. This sterility, in diploid hybrids, is considered to be a chromosomal sterility caused by meiotic disturbances and the formation of inviable gametes. The nature of male sterility in tetraploid hybrids is unknown.

Tumours possessing branching ability, probably induced by unbalanced growth processes, were observed on several hybrid plants. It is considered that certain genome combinations were possibly responsible for their formation.

Extensive details are given on the morphology of flower, inflorescence, fruit and other plant parts in both species and hybrids. The significance of the use of polyploids in these studies is discussed briefly.

2109 Kamra, S. K.
Techniques for identifying varieties of *Beta vulgaris* in the laboratory.
Indian J. Genet. 1960 : **20** : 126–35.

Seedling colour was found to be a useful guide in the identification of different *B. vulgaris* types, and in the differentiation of mangels from sugar and fodder beets.

2110 Kruse, A.
Polyembryony in *Brassica napus* v. *rapifera* L. and *Beta vulgaris* L.
K. VetHøjsk. Aarsskr. 1960 : 37–46.

The frequency of polyembryony was determined in germinating seed of swede and beet. Two of nine swede strains had no multiple embryos, but in the others twins, triplets and quadruplets were found. Twins and triplets occurred among the nine beet varieties, the lowest frequency of twins being found in the only tetraploid studied, Pajbjerg Korsroe. The very small weak seedlings occasionally forming one member of the twins or triplets in both species may be haploid, and a water-culture method for growing them has been devised.

2111 Meier, W.
Ergebnisse weiterer Lagerungsversuche mit Futterrüben. **(The results of further storage trials with mangels).**
Mitt. schweiz. Landw. Zürich-Oerlikon 1960 : **8** : 113–21.

Tonnage mangel varieties had lost as much sugar halfway through the storage period as fodder sugar beets lost throughout the whole period; half-sugar beets were intermediate in this respect. Also tonnage varieties lost more starch than fodder sugar beets and had the greatest percentage of diseased roots.

2112 Yukura, Y.
(Studies on turnip breeding. I. The estimation of heritability and degree of dominance).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 96–100. [Japanese].

The characters studied were plant weight and leaf and root characteristics in the small turnip variety Kanamachi. Partitioning of variance components showed that all the characters studied had zero or low heritabilities except root shape in which values up to 66% were obtained. All the characters showed strong dominance except root shape.

2113 WATERSON, H. A.
Swede variety trials in the West of Scotland.
J. nat. Inst. agric. Bot. 1959 : **8** : 640–50.

Information is given on the performance of the following varieties in 23 trials: Peerless, Stirling Castle, Aberdeenshire Prize, Darlington, Parkside White Fleshed and Wilhelmsburger.

2114 SANTI MUKHERJEE
A note on the chromosomes of *Coleus parviflora*.
Indian J. Genet. 1959 : **19** : 116–18.

The diploid chromosome number is reported to be 56. Some variation in chromosome number was however noted and this is attributed to the fact that the species is a vegetatively propagated plant in which sexual reproduction is considerably reduced. The chromosomes are classified and the caryotype of the species is given.

2115 LONG, D. H.
Second early potato variety trials, 1951–57.
J. nat. Inst. agric. Bot. 1959 : **8** : 630–39.

A summary is given of the results of 96 trials carried out on Chancellor, Pentland Ace and Ulster Dale, with Craigs Royal as control, at several centres in England.

2116 TUŞA, G.
Despre unele metode de ameliorare a cartofului folosite în R.D.G. (**On some potato breeding methods used in the German Democratic Republic**).
Probl. Agric., Bucureşti 1960 : **12** : No. **7** : 64–70.

The methods and organization of potato breeding in the above country are reviewed for the benefit of Rumanian readers.

Ergebnisse der Sortenprüfung im Jahre 1959. (**Results of varietal testing in the year 1959**).
Kartoffelbau 1960 : **11** : 46–50.

2117 *Roemer. Ansprüche und Leistungen—eine kritische Betrachtung. (Demands and achievements, a critical survey). (p. 46).*

It is pointed out that growers, merchants and the various users of potatoes differ in the characters they require in a potato variety.

2118 *Höppner, E. Sortenprüfung 1959. (Variety testing, 1959). (pp. 46–50).*

Tabulated data are provided on the important characters of varieties grown in the German Federal Republic in 1957–59. It is also shown in diagrams which of the three groups of potatoes, culinary, industrial and dual purpose, has most varieties excelling in each of 10 characters.

2119 JÄHNL, G.
Ergebnisse der Kartoffelversuche des Jahres 1959. (**Results of the potato trials of the year 1959**).
VersErgebn. BundesVerAnst. alpenländ. Landw., Gumpenstein 1960 : No. 51 : Pp. 90. (Mimeographed).

Trials held at centres in Austria are reported in detail.

2120 ZANOTTI, L.
La coltura della patata oggi. (**Potato cultivation today**).
Ital. agric. 1960 : **97** : 905–37.

Information is provided on the performance of named varieties and recently bred experimental strains in a number of Italian localities.

2121 RØNSEN, K.
Sortsforsøk med poteter i fjellbygdene 1948–58. (**Varietal trials of potato in the mountain districts, 1948–58**).
Forskn. Fors. Landbr. 1960 : **11** : 435–57.

Data on yield, incidence of disease, dry matter content, tuber size and cooking quality are given for 26 varieties tested at various mountain stations in Norway, and descriptive notes on the best varieties are provided.

2122 Forsøg med sildige kartoffelsorter 1955–58. (**Trials of late potato varieties, 1955–58**).
Tidsskr. Planteavl. 1960 : **64** : 365–68.

Data are given on the yield, dry-matter content, tuber size, earliness, disease resistance and quality of a number of Netherlands and German varieties compared with Dianella and Alpha at six Danish stations.

2123 BRETAN, C., CONSTANTINESCU, E, FELECAN, V. & BRETAN, I.
Studiul agrobiologic al soiurilor de cartof din colecţia Staţiunilor Cluj şi Măgurele. (**The agrobiological study of the potato varieties in the collection of the Cluj and Măgurele stations**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 171–92.

A comparative study of 83 Rumanian and introduced bred varieties, 28 local populations and 7 wild species is reported. Observations were made on yield, vegetative period, crossability, resistance to late blight and wart and virus diseases and content of starch and protein. Similar data are also provided on numerous intervarietal hybrids.

2124 WHEELER, E. J.
Impact of research on potato cultivation in India.
Indian Potato J. 1959 : **1** : 73–75.

The aims and progress of the Central Potato Research Institute, Simla, in the development of improved varieties for hill and plain regions of central and southern India are briefly reviewed.

• **Abstracts of papers presented at the Forty-fourth Annual Meeting of the Potato Association of America.**
Amer. Potato J. 1960 : **37** : 344–55.

2125 *Blomquist, A. W. & Lauer, F. I. A comparison of first clonal generation potato progeny performance at two Minnesota locations.* (*p. 344*).

A comparison was made of the performance of 16 first clonal-generation progenies involving 850 clones. Significant location x progeny and location x clone interactions were obtained, which could be partly attributed to differences in maturity of the parents. Seed-tuber size greatly influenced performance. Although the numbers of clones selected in both localities were similar, selection of the same clone at the two centres seldom occurred. In most cases the clone selected at only one centre was derived from the larger of the two tubers used for testing each clone.

2126 *Blomquist, A. W. & Lauer, F. I. A simplified technique for the storage and handling of potato pollen.* (*pp. 344–45*).

Pollen was collected directly from the variety Redkote in gelatin capsules, using a mechanical vibrator. The results of crosses indicated that the pollen remained viable for at least one year stored at −24° C. Storage with $CaCl_2$ did not affect viability.

2127 *Cipar, M. S., Peloquin, S. J. & Hougas, R. W. Incompatibility relationships of haploids from* Solanum tuberosum *subsp.* andigena. (*p. 345*).

Two haploids, US–W246 and US–W253, derived from a self-fertile selection of ssp. *andigenum*, were pollen and ovule fertile, as indicated by ability to hybridize readily with *S. phureja*. Attempts to self the haploids failed. Hybrid seed was obtained when US–W253 was crossed as ♀ with US–W246; the reciprocal mating was unsuccessful. It has not been possible to cross either haploid with the *andigenum* parent. Fruit development was however initiated when the haploid constituted the female parent, and continued for 6–8 days. No fruit development was detected in the reciprocal mating. These results may be explained on the basis of a gametophytic type of incompatibility.

2128 *Cunningham, C. E. & Stevenson, F. J. Potato genetics: inheritance of chip color and dry matter content.* (*p. 345*).

Study of the breeding behaviour of 12 parental clones, which were classified as high, intermediate or low for crisp colour after cold storage and reconditioning, showed that the crisp colour of the parents provided a reasonable estimate of their behaviour in this respect in crosses. Segregation for crisp colour and dry-matter content appeared to be independent.

2129 *Dionne, L. A., Graham, K. M. & Hodgson, W. J. The inheritance of resistance to higher races of* Phytophthora infestans. (*p. 346*).

Resistance to the following races was incompletely dominant: 1,2,3,4,5; 1,2,3,4,6; and 1,2,3,4,5,6. In crosses of immune x susceptible parents, the majority of the hybrids had an intermediate degree of resistance, only an occasional plant possessing resistance approaching that of the resistant parent. Intercrossing of susceptible hybrids yielded various proportions of immune individuals, depending upon the parents. All hybrids from immune x susceptible combinations equalled or exceeded European field resisters in general resistance, while the general reaction of the more resistant hybrids approached immunity. By this outcrossing-sibcrossing system, the full resistance of *S. demissum* was apparently maintained. This was easily accomplished by overcoming the cytoplasmic ♂ sterility of the *S. demissum* x *S. tuberosum* derivatives through appropriate initial crosses.

2130 *Graham, K. M., Hodgson, W. A. & Dionne, L. A. Mutability of* Phytophthora infestans *on blight-resistant selections of potato and tomato.* (*p. 346*).

Two methods were used to select variants capable of attacking foliage of resistant selections. (1) Plants were decapitated and lateral buds removed, so as to induce giant succulent leaves susceptible to invasion by the pathogen. (2) The fungus was cultured on senescent, yellowing leaves of resistant varieties. After 10–14 days on detached leaves of these two types, the fungus sporulated and could be reinoculated in leaves of a susceptible variety for a secondary build-up. A series of alternate host passages has usually resulted in the appearance of a strain capable of attacking the resistant variety. The following racial shifts were detected: 1,2,3,4 to 1,2,3,4 + T_1; 0 to T_1; 1,2,3,4 to 1,2,3,4,6; 1,2,4 to 1,2,3,4; and 1,3,4 to 1,2,3,4. The number of passages required to produce a shift in host range varied with the race and host. "The presence of a physiological state in senescent or giant leaves which allows growth of the fungus, in combination with the selective effect of 'residual' resistance upon the population of fungus nuclei, appears to permit the survival and selection of mutant nuclei." Mutation to increased virulence, favoured by prolonged association with resistant hosts in susceptible phases of their growth cycle, may be responsible for the appearance of "new" races in countries where the sexual stage has not been found.

2131 *Hodgson, W. A., Dionne, L. A. & Graham, K. M. Laboratory testing for intermediate levels of resistance to* Phytophthora infestans. (*p. 347*).

In greenhouse-grown potato plants, varieties found to be highly resistant in field tests were resistant to a higher spore concentration in the inoculum than moderately resistant or susceptible varieties. Differences in varietal resistance which could be correlated with field reactions were demonstrated in laboratory tests by inoculating leaf discs with standardized drops of inoculum containing known spore concentrations. Resistance could be shown to be due to any or all of the following: resistance to infection, (2) resistance to invasion of the leaf tissue by the mycelium and (3) inhibition of sporulation. Disparities in resistance could be demonstrated when either the upper or lower leaf surface was inoculated.

2132 *Hougas, R. W. & Peloquin, S. J. Initial evidence concerning the feasibility of potato breeding at the diploid level.* (*p. 348*).

Haploids of *S. tuberosum* occur with a relatively high frequency among the progenies resulting from *S. tuberosum* ♀ x *S. phureja* ♂. To date, nearly 500 haploids of cultivated potato have been isolated from a total of 31 different tetraploid parents. The frequency of highly pollen-fertile individuals among the "raw" haploids is low. Female fertility is however relatively high. Progenies have been secured from crosses between haploids and from matings of haploids with 23 tuber-bearing diploid species. [Cf. XXX, 515].

2133 *Kollmer, G. F. & Larson, R. H. Host range, properties, varietal reaction and resistance in relation to isolates of potato virus F.* (*p. 349*).

Among the observations reported is the following. Resistance to virus F was found in *S. chacoense* and several interspecific hybrids involving this species.

2134 *Peloquin, S. J., Hougas, R. W. & Gabert, A. C. The frequency of haploids in* Solanum tuberosum. (*p. 350*).

Twelve varieties and 21 pollinators were used in an investigation of the effect of parent and pollinator upon the frequency of haploids secured through interspecific matings. Choice of the *S. tuberosum* parent had a highly significant effect, Merrimack and Tawa producing the highest frequency. Unexpectedly, the pollinator also had a highly significant influence, one selection of *S. phureja* (PI225682) being about ten times more effective than any of the other pollinators. Similar results were obtained when this particular pollinator was used with selections of *S. tuberosum* ssp. *andigenum* as ♀. [Cf. XXX, 521].

2135 *Picha, B. Erlired, a new red-skinned potato variety with high red color, market attractiveness, earliness and easy to grow and handle.* (*p. 350*).

The above variety, developed from a cross between two seedling selections, has moderate resistance to scab but is susceptible to late blight.

2136 *Plaisted, R. L., Sanford, L., Federer, W. T., Kehr, A. E. & Peterson, L. C. Estimates of combining ability of potato clones.* (*pp. 350–51*).

Information is given on the plot procedure used in test-cross trials. "The data have been analyzed to compare the relative magnitude of the components of variance attributable to general and specific combining ability. Estimates of the general combining ability effects of each of the lines have been obtained. The interaction of general combining ability effects with locations is compared with the interaction of specific combining ability effects with location. Estimates of the optimum number of testers required to adequately measure general combining ability are presented."

2137 *Darling, H. M. & Akeley, R. V. Resistance to potato rot nematode.* (*p. 355*).

Three parents, B3097–82, B3139–24 and B3309–8, and five seedlings showed resistance to *Ditylenchus destructor*, when tested twice in the greenhouse. B4312–4, derived from B3309–8 x B3139–24, was one of the seedlings.

The National Potato-Breeding Program, 1959.
US Dep. Agric. 1960 : Pp. vii + II + 236. (Mimeographed).

Contributions dealing only with yield trials of seedlings and varieties are here omitted [cf. XXX, 2812–46].

2138 *Akeley, R. V. National potato-breeding program, 1959. (pp. I–II).*

The following newly-introduced varieties are described; Redskin, Fundy, Catoosa, Navajo, Blanca, Eréndira, Anita, Bertita, Conchita, Bounty and Allehanna.

2139 *Akeley, R. V.* et al. *Plant Industry Station (Beltsville, Md.) and Chapman and Aroostook farms (Presque Isle, Maine). (pp. 1–8).*

Tabulated information is presented on yield, quality and disease resistance trials conducted at the three stations.

2140 *Schark, A. E., Akeley, R. V. & Manzer, F. E. Verticillium wilt resistance in variety and seedling tests. (pp. 8–10).*

Of 15 selections tested at Aroostook, the varieties Houma and 792–94 were most resistant to *Verticillium.*

2141 *Varietal reaction to net necrosis and stem-end browning. (p. 11).*

Only Mohawk and Green Mountain showed symptoms of net necrosis while seven other selections were free from the disease. No symptoms of stem-end browning occurred in any of the nine varieties in the test.

2142 *Late blight injury as reflected in yield and percentage of solids. (p. 11).*

The effect of late blight on yield and percentage solids in six varieties is recorded. Best results were obtained from the resistant varieties Kennebec and Merrimack.

2143 *Akeley, R. V., Peterson, L. C. & Schark, A. E. Golden nematode resistance. (pp. 12–16).*

Tabulated information is presented on the response of a number of new selections to golden-nematode infection.

2144 *Buck, R. W. (Jun.).* Solanum *species and hybrids. (p. 16).*

Investigations on crossability among *Solanum* species and on meiosis in species and interspecific hybrids were continued in 1959. Several clones of 7 tetraploid, 36 triploid and 52 diploid hybrid combinations were grown for cytological study. Meiosis was regular in the diploid and tetraploid hybrids investigated.

Attempts were made to produce hybrid seed among numerous species and hybrids. Of 553 combinations among diploid species, 109 produced seed. F_2 seed was obtained from six diploid interspecific hybrids and from four tetraploid hybrids. Back crosses were obtained from 14 diploid F_1 hybrids and from 4 tetraploid F_1 hybrids. With few exceptions, the majority of interspecific hybrids obtained to date have been vigorous plants with considerable fertility. In many instances fertility has been equal to that of the parent species.

2145 *Webb, R. E.* et al. *Potato disease investigations. (pp. 16–28).*

Seedling screening for resistance to late blight and to viruses A, X and Y under field and greenhouse conditions was continued. The results of the screening programme are tabulated.

2146 *Webb, R. E. & Schultz, E. S. Further evaluations of* Solanum *species and species hybrids for resistance to disease. (pp. 29–33).*

Five selections of *S. tuberosum* ssp. *andigenum*, one of *S. maglia* and two interspecific hybrids were highly resistant to viruses A and X. Two selections of *S. chacoense*, two of *S. hougasii*, three of *S. stoloniferum* and one interspecific hybrid were highly resistant to viruses A and Y. The foreign varieties Majestic, Pentland Ace and Urgenta showed high resistance to virus Y, while Pentland Ace also demonstrated high resistance to field infection by late blight.

2147 *Hougas, R. W. & Peloquin, S. J. Genetics and cytogenetics of the tuber-bearing* Solanum *species. (pp. 35–36).*

Studies on haploidy in the potato have continued [cf. XXX, 2820]. The choice of both the *S. tuberosum* parent and the pollinator was found to have a significant effect on the frequency of haploids. The maximum number of haploids was produced with Merrimack as the maternal parent and an *S. phureja* line, PI225682.1, as pollinator. Matings between *S. tuberosum* haploids and 23 diploid species resulted in 198 F_1 progenies, many of which showed considerable hybrid vigour. Meiosis was found to be highly regular in all the F_1 plants examined.

2148 *Kehr, A. E.* et al. *North central regional trials 1959. (pp. 37–42).*

The selection Neb. 156.48–2x has been released as Bounty. Tabulated information is given on yield, maturity, total solids, scab resistance and external and internal defects of 16 varieties grown in ten north central areas.

2149 *Bienz, D. R. Pacific northwest. (pp. 43–51).*
On the basis of the results of extensive clonal trials, 12 clones are being increased for further testing. Trials in 1958 and 1959 have indicated that Canoga, White Rose and A170–9 possess some resistance to *Fusarium eumartii*. A large number of seedlings have been screened for resistance to *Verticillium* wilt and to leaf roll. Special techniques of selection used at the Tetonia Branch Experiment Station, Idaho (altitude 6300′), are described.

2150 *Dykstra, T. P. Southern project. (pp. 52–55).*
Seedling TL6279, released as Catoosa, is immune from the common races of late blight and has considerable resistance to scab. Excellent preliminary results have been obtained with the white seedling TL6937.

2151 *Johnston, G. R. & Rowberry, R. G. Canada. (pp. 58–60).*
Data are presented on yield, maturity, total solids, cooking quality and external tuber defects of 98 seedlings and varieties originating in the U.S.A.

2152 *Weigle, J. L., Frutchey, C. W. & Binkley, A. M. Colorado. (pp. 61–67).*
Resistance to scab was noted in the variety Haig in contrast to 15 other varieties, all of which were infected.

2153 *Eddins, A. H. Florida. (p. 74).*
Six varieties, Delus, Merrimack, Plymouth, Pungo, Saco and Eigenheimer, and four selections, B294–65, B606–3, B3725–1 and TL1859, showed no symptoms of corky ring spot when grown in infested soil.

2154 *Sanford, L., Horton, J. C., Hibbs, E. T., Orgell, W. H. & Carlson, O. V. Iowa. (pp. 82–91).*
Investigations on heterosis in the potato and on the relative value of six tester stocks are now in progress. A number of selections have been rated for resistance to the flea beetle, *Epitrix cucumeris*, and the leaf hopper, *Empoasca fabae*. The mechanisms of resistance to these insects are discussed.

2155 *Miller, J. C. Louisiana. (pp. 95–100).*
Resistance to common scab has been shown by seedlings 62–91, 62–162, 72–60, 72–100, 81–59 and 91–143, and to late blight by 62–162, 91–143 and 91–78.

2156 *Simpson, G. W. et al. Maine. (pp. 106–10).*
Field testing for leaf-roll resistance has been continued. The reaction of progenies of different crosses and of selfed lines to infection is tabulated.

2157 *Bonde, R. et al. Maine. (pp. 111–14).*
A number of seedlings have remained free from ring-rot symptoms, despite annual exposure for several years.

2158 *Weeks, M. E. & Field, D. Massachusetts. (pp. 115–16).*
Information on the severity of a blight attack on 24 varieties in 1959 is reported. Saco was the only variety to remain free from the disease.

2159 *Thompson, N. R., Isleib, D. R., Wheeler, E. J., Hooker, W. J. & Meduewesi, J. N. C. Michigan. (pp. 120–23).*
A study is now in progress on the inheritance of immunity to virus X in segregating seedling populations. Some preliminary data are presented.

2160 *Lauer, F. I. et al. Minnesota. (pp. 124–28).*
A large number of clones have been screened for resistance to scab and late blight.

2161 *O'Keefe, R. B., Werner, H. O. & Miyoshi, R. T. Nebraska. (pp. 130–46).*
Information is provided on a number of superior new selections now undergoing multiplication. The results of trials to determine heat resistance in 13 Nebraska selections are reported. The reliability of the chlorophyll stability index (CSI) as a means of identifying heat-resistant clones has been studied but no final assessment can yet be made. Genetic studies on the inheritance of heat resistance have indicated that susceptibility is dominant to resistance. Greenhouse tests showed that Red Beauty, Excel and Red Pontiac were the least susceptible of ten varieties to *Verticillium* wilt. The breeding of parental lines for resistance to scab, heat and drought has continued.

2162 *Peterson, L. C. & Plaisted, R. L. New York. (pp. 154–59).*
Solanum vernei has been used as a source of resistance to golden nematode in crosses with *S. tuberosum*.

2163 *Ewing, E. E. & Smith, O. New York. (pp. 162–68).*
Blanca and Plymouth have shown resistance to scab, while 150–1 and JGQ–1 appear to have resistance to black spot and late blight.

2164 *Johansen, R., Benson, A. P. & Lana, E. P. North Dakota.* (*pp. 169–80*).

Resistance to race 0 of late blight combined with immunity to virus X has been demonstrated in 13 selections. *Solanum stoloniferum* has been incorporated into the breeding programme with a view to introducing resistance to virus Y. A total of 194 advanced selections have been tested for resistance to silver scurf, *Spondylocladium atrovirens*. A number have shown more resistance to this pathogen than the controls, Cherokee, Red Pontiac and Cobbler.

2165 *Sleesman, J. P. Ohio.* (*pp. 184–88*).

A number of selected seedlings, interspecific hybrids and *Solanum* species have been screened for resistance to leaf hopper and flea beetle. Resistance to these insects in the 1959 trial was present in samples of *S. berthaultii*, *S. chacoense*, *S. polyadenium*, *S. setulosistylum*, *S. simplicifolium* and, to a lesser extent, in other species and hybrids.

2166 *Perry, B. A.* et al. *Texas.* (*pp. 199–207*).

Information is provided on the disease-resistance properties of 238 lines, selected from more than 20,000 seedlings.

2167 *Locke, S. B. Washington.* (*pp. 214–15*).

Information from a project designed to improve resistance to leaf roll has indicated that field testing is inadequate; information on other possible methods for assessing resistance is necessary.

2168 *Hoyman, W. G. Washington.* (*pp. 216–19*).

The reaction of a large number of selections, as well as some *Solanum* species, to leaf roll, virus Y and *Verticillium albo-atrum* is reported. No symptoms of any sort appeared on B2759–5 or B3820–14; a number of other strains showed resistance to one or two of the pathogens.

2169 *Westover, K. C. & Shumaker, J. R. West Virginia.* (*pp. 220–22*).

Information on the disease resistance of a number of varieties is reported.

2170 *Larson, R. H. & Akeley, R. V. Wisconsin.* (*p. 223*).

Boone showed complete resistance to non-parasitic internal tuber necrosis, while two seedling selections, B2187–25 and B3329–13, were only slightly affected.

2171 DEARBORN, C. H.

Performance of 127 potato varieties in Alaska 1951–1959.

Bull. Alaska agric. Exp. Sta. 1960 : No. 29 : Pp. 26.

Information is provided on the agronomic characteristics of 127 varieties, as observed in tests in different localities in Alaska.

2172 QUEVEDO DÍAZ, A.

Contribución al estudio de algunos caracteres agronómicos y nutritivos de variedades peruanas de papas. (**A contribution to the study of some agronomic and nutritional characteristics of Peruvian potato varieties**).

Inf. mens. Estac. exp. agríc. La Molina 1959 : No. 113 : 1–23. (Mimeographed).

Tabulated information is provided on the yield, flowering period, quality and disease resistance of 24 varieties grown at the Agricultural Experiment Station, La Molina, Peru. Chimbina de Cochamarca, the highest-yielding variety in the trial, showed resistance to isolate F15–55 of *Phytophthora infestans*, while the second highest yielder, Púrpura de Carabamba [Carabamba Purple] was resistant to isolate F7–55.

2173 PERRY, B. A., AKELEY, R. V. & COOK, W. B.

A potato breeding technique used for Texas.

Amer. Potato J. 1960 : **37** : 306–07.

A technique is described which is designed to accelerate the multiplication and testing of seedlings obtained through the National Potato Breeding Program from Beltsville, Md. First-generation seedlings are harvested in Beltsville and then sent directly to Texas. Towards the end of January, the seedlings are treated with potassium thiocyanate and, subsequently, are planted out. After harvesting in May, selection of superior types is made on the basis of desirable horticultural characters. The selected tubers are multiplied in Maine.

2174 GRUN, P. & RADLOW, A.

The gene-plasmon interactions of *Solanum phureja* and *S. chacoense*.

Genetics 1960 : **45** : p. 990. (Abst.).

F_1 hybrids between *S. phureja* and *S. chacoense* are generally vigorous, normal in development and fertile. When the hybrids were back crossed with *S. chacoense*, the direction of the back crossing determined the nature of the progeny. When the hybrid was used as ♀, sterile or morphologically disturbed segregates appeared, the type of disturbance varying according to the form of *S. chacoense* constituting the recurrent parent. Back-cross ratios of normal : disturbed plants were explicable as single-gene effects. The reciprocal back crosses were normal in appearance, but varying proportions of the progeny were sterile, some being ♂ sterile only, some ♀ sterile only and others both ♂ and ♀ sterile. The ♂ sterility was due to sporocyte degeneration, usually at prophase. The abnormalities are attributed to irregular gene-plasmon interactions.

2175 HÖPPNER, E.
Die zur Anerkennung 1960 zugelassenen Kartoffelsorten. (**The potato varieties approved for 1960**).
Kartoffelbau 1960 : **11** : 119–22.

Information is provided on the morphological characters by which plants of the approved varieties may be recognized. Additional details of the appearance of eleven varieties, Barima, Carla, Advira, Risa, Königsmark, Irmgard, Gunda, Tondra, Tosca, Saphir [Sapphire] and Majo, recently added to the official list in Federal Germany, are tabulated.

2176 Sortenratgeber. Kartoffeln. (**Variety adviser. Potatoes**).
DLG-Verlag, Frankfurt am Main 1960 : Pp. 42.

Information is provided on the important characters of 90 varieties tested in Federal Germany.

2177 **Issue on varieties 1960.**
Potato News Netherlands 1960 : **8** : No. 4 : Pp. 27.

Descriptions of 62 varieties are presented, together with information on parentage, performance under Netherlands conditions and the names of the breeders and suppliers.

2178 KELLER, E. R.
Bericht über die Hauptversuche mit mittelfrühen bis frühen Speisekartoffelsorten 1957–1959 (Serie 39). [**A report on the main trials with medium early to early culinary potato varieties, 1957–1959 (series 39)**].
Mitt. schweiz. Landw. Zürich-Oerlikon 1960 : **8** : 97–109.

Descriptive notes and full details of the results of trials held in Switzerland are given for four new varieties. Avenir [Future], originating from the cross (A42 x Voran) x Katahdin, has been mentioned elsewhere [cf. XXVIII, 683]; it gave the best average yield. Grata (Ackersegen x Flava) is a medium early variety with a white skin and yellow flesh; its yield is a little below that of Bintje. Grata has good resistance to *Phytophthora* in foliage and tubers and to *Synchytrium endobioticum* and is only slightly susceptible to *Streptomyces scabies*; it is susceptible to internal rust spot and virus diseases. In cooking quality Grata resembles Bintje but has not quite such a fine taste and the starch content and tuber size are lower.
Hansa, from the cross Oberarnbacher Frühe [Oberarnbach Early] x Flava, is another medium-early variety with white skin, yellow flesh and a yield slightly below that of Bintje. It is resistant to wart and moderately resistant to *Phytophthora* and does not suffer greatly from scab or internal diseases of the tuber; it is however very susceptible to virus diseases. The cooking quality of Hansa is similar to that of Bintje and it keeps moderately well.
Gallo, from a cross of Oberarnbacher Frühe x a breeding line, is early to medium early and has white skin and yellow flesh. It usually gives a good yield and is resistant to wart and scab and more resistant to *Phytophthora* than Bintje but is susceptible to internal rust spot. Gallo is also susceptible to viruses but is tolerant of the leaf-roll virus. Its taste is not quite so good as that of Bintje and it has 2% less starch; it keeps well.

2179 Les variétés de pommes de terre en Suisse. Choix et préparation pour la culture. (**Potato varieties in Switzerland. Choice and preparation for culture**).
Rev. rom. Agric. 1960 : **16** : 85–98.

Tabulated information is given on the source, culinary type, starch content, degree of blackening after cooking, tuber form, flesh and skin colour, growth habit, maturity, yield, proportion of small tubers, soil requirements, susceptibility to various diseases and suitability for storage of 15 varieties from the official Swiss collection.

2180 PUSHKARNATH
Commercial potatoes in India: Phulwa.
Indian Potato J. 1959 : **1** : 124–26.

This description of an old and widely-grown variety includes a note on a new disease-free strain selected at the Central Potato Research Institute, Simla, and named Kufri Safed. The new strain resembles Phulwa but has slightly larger leaves; it has outyielded the parent variety by 25%.

2181 Tres nuevas variedades de papas resistentes al tizón tardío se crean en México. (**Three new varieties of potato, resistant to late blight, are bred in Mexico**].
Extens. Amér. 1960 : **5** : p. 27.

The varieties Anita, Bertita and Conchita are described briefly [cf. XXX, 519].

2182 Werner, H. O. & O'Keefe, R. B.
New potato varieties help Nebraska growers.
Neb. Exp. Sta. quart. 1960 : **7** : 12–13.

The varieties Progress (cf. XXIV, 3118), Excel (XXX, 2821) and Bounty (XXX, 1697) are described. Haig, released in 1957 by the Nebraska Agricultural Experiment Station, produces oblong to round, white russet tubers with high resistance to common scab. Yields have been satisfactory in all parts of Nebraska. The tubers are high in cooking quality and are suitable for making crisps.

2183 Höppner, E.
Gibt es neue stärkereiche Kartoffelsorten? (**Are there new potato varieties rich in starch?**)
Kartoffelbau 1960 : **11** : No. 6 : Stärkekartoffel **5** : No. **3** : p. 3.

The new variety Saphir [Sapphire] gives a good yield of starch, the starch content of the tubers being 17%. Most of the tubers are large and have rather bright yellow flesh; they mature a little later than those of Heida. Saphir is resistant to some wart biotypes and is immune from virus X. Irmgard and Königsmark are productive medium-early varieties suitable for fodder, although their starch content does not average over 16%. Irmgard produces rather large tubers and is not susceptible to late blight in the tubers. Königsmark withstands drought well and produces rather large tubers of only average culinary quality and form; its foliage is slightly susceptible to late blight.

2184 **Murru—a new red skinned potato variety.**
Agric. Gaz. NSW 1960 : **71** : p. 500.

Murru, a selection from the cross Gold Coin x Saranac, was developed at the New England Experiment Farm. The yielding capacity of the new variety is similar to that of Sebago. Murru possesses better than average field resistance to both early and late blight and has shown very good resistance to common scab. The tubers, which tend to be uniformly medium in size, have crisp, white flesh, suitable for cutting. Cooking quality is good, and remains so even after fairly long storage.

2185 Driver, C. M.
Tahi and Rua. Two new potato varieties.
NZ J. Agric. 1960 : **101** : 218–20.

Tahi and Rua, the first two potato varieties bred by the Crop Research Division, Department of Scientific and Industrial Research, NZ, are described [cf. 1578].

2186 Choudhuri, H. C.
Spread of rugose mosaic and leaf roll in different varieties of potatoes in the plains of west Bengal.
Amer. Potato J. 1960 : **37** : 173–75.

Trials conducted over a 4-year period at the State Agricultural College Experimental Farm, Calcutta, demonstrated that potato varieties vary widely in their susceptibility to rugose mosaic and leaf roll. Resistance to these diseases was shown by Voran, Rungbull–12, Royal Kidney, Magnum Bonum, Sebago, Irish Cobbler, Bonderslev and Northern Star.

2187 Vălčev, P.
(Investigation on the varietal composition of local potatoes in Bulgaria).
Izv. central. naučnoizsled. Inst. Rasten. (News central. sci.-res. Inst. Pl.-Industr.), Sofija 1960 : **9** : 223–49. [Bulgarian].

In this survey of local Bulgarian varieties, it is noted that: (*a*) certain *Solanum andigenum* characters are found in Červen kăsen [Red Late]; (*b*) most varieties are highly resistant to virus Y; (*c*) good resistance to leaf roll is found in Bjal ran [White Early] and Bjal jajceviden [White Oval] and (*d*) blight resistance occurs only in Červen kăsen.

2188 Dodds, K. S.
The potato at home.
Agriculture, Lond. 1960 : **67** : 459–63.

On the basis of observations made during his recent visit to South America, ranging from Venezuela to Chile, the author describes potato cultivation and the indigenous types grown, and briefly indicates the value of South American cultivars as a reservoir of genetic variability for use by breeders in temperate countries.

2189 Lunden, A. P.
Some more evidence of autotetraploid inheritance in the potato (*Solanum tuberosum*).
Euphytica, Wageningen 1960 : **9** : 225–34.

The segregation ratios of crosses involving the genes *R*, which together with *D* gives tubers with colourless skin and eyes but a red cortex, and *F*, which together with *D* gives violet-red flowers irrespective of tuber colour, are in agreement with the assumption that *S. tuberosum* is an autotetraploid. *R* and *F* are generally inherited independently but in Pimpernel they appeared to be very closely linked while in

Ringerik ($D_2d_2R_2r_2Ff_3$) they seemed to be in repulsion, F being located in another chromosome than the two R factors, with very little crossing over between the two loci. Deviations from the expected ratios in the above crosses and in a further cross involving both R and E, which together with D gives a red skin, coloured eyes and violet-red flowers, could be attributed to double reduction at D.

2190 MAGOON, M. L. & RAMANUJAM, S.
Nature of chromosome pairing in the genus *Solanum* section *Tuberarium*.
Indian J. Genet. 1960 : **20** : 22–41.

Cytogenetical studies in section *Tuberarium* are critically surveyed and the following categories of evidence of genome differentiation are considered: (1) chromosome morphology, (2) chromosome pairing at various degrees of ploidy, (3) secondary association, (4) genetics, including polysomic inheritance, self incompatibility and the occurrence of aberrant plants, and (5) cytoplasmic differences within *Solanum* species. It is concluded that there is some evidence, particularly from triploid cultures derived from crosses between artificial tetraploids and diploid species, "that the possibility of the basic number being 6 or lower than 12, at least in the earlier stages of the evolution of this group, must be given serious consideration." Concerning species differentiation it is thought probable that patent structural changes in the chromosomes were involved in addition to the cryptic structural changes, gene substitutions and other factors postulated by earlier workers.

2191 PELOQUIN, S. J. & HOUGAS, R. W.
Genetic variation among haploids of the common potato.
Amer. Potato J. 1960 : **37** : 289–97.

A study of genetic variability among 29 haploids ($2n = 24$) of the potato, grown at Sturgeon Bay, Wis., is reported [cf. XXIX, 1714]. With only a few exceptions, the plant parts of the haploids were smaller in size as compared with the diploid parents from which they were derived. Tuber yields were also lower in the case of the haploids, with the exception of US–W20, which outyielded its parent variety Katahdin. Of the 23 haploids that flowered, 22 proved to be functional as female parents, while US–W1, derived from Katahdin, and US–W4, from Minn. 20–20–34, were functional both as male and female parents in interhaploid crosses as well as in matings with *Solanum phureja* ($2n = 24$). Certain genetic consequences of haploidy are discussed.

2192 LEBEDEVA, N. A.
(Production of polyploids of the wild potato species *Solanum bulbocastanum* Dun., *S. cardiophyllum* Lindl. and *S. vernei* Bitt. et Wittm.).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1960 : **134** : 1211–13. [Russian].

Colchicine-induced polyploids ($2n = 48$) of the above species from the Institute of Plant Industry have been obtained. The tetraploid of *S. bulbocastanum* formed no berries on selfing but produced tubers under short days, these being larger than those of the initial form. This tetraploid is resistant to virulent races of *Phytophthora* and *Alternaria*. Tetraploid *S. cardiophyllum* showed improvement in tuber size and resistance to *Alternaria*. The tetraploid of *S. vernei* is vigorous and develops larger tubers than the diploid under long days. It formed one berry on selfing, but this did not ripen; it crosses readily with *S. tuberosum*.

2193 MANICKAVASAGAM, P. & RADHAKRISHNA ALWA, K.
Preliminary note on the economic importance of potato bolters.
Madras agric. J. 1960 : **47** : 445–46.

At the Agricultural Research Station, Nanjan, bolting plants of the variety Great Scot were found to be more resistant to virus diseases than normal plants. Yield data collected over a 3-year period showed that bolters were capable of yielding more than normal plants.

2194 VESELOVSKIJ, I. A.
(The length of the dormant period).
Kartoffel' (Potato), Moskva 1959 : No. **5** : 33–37. [Russian].

The dormancy of potato tubers is discussed in relation to variety, storage conditions and preplanting treatments. Some varieties that are dormant for 30–34 weeks and others for less than 21 weeks are listed. In addition to these mention is made of Hibinskij Skorospelyj [Hibiny Early], Hibiny 3, Šuntuk, Radžabli and hybrids of these with other potato cultivars which have such short dormant periods that they are referred to as "aperiodic forms".

2195 PUSHKARNATH
Crossability in diploid Solanums.
Indian Potato J. 1959 : **1** : 84–95.

From the results of a large number of crosses involving diploid species belonging to sections *Cardiophylla*, *Pinnatisecta*, *Commersoniana*, *Demissa*, *Polyadenia* and *Tuberosa*, it was found that incompatibility within sections conforms to the gametophytic homomorphic system of incompatibility [XXVIII, 3642]. Crossability between different sections however does not conform to this system, and, on the basis of this and earlier evidence [XXV, 1687], it is therefore suggested that crossability between the various groups may be determined by a number of unrelated and independent genes.

2196 Novák, F.
Obsah bílkovin v bramborách. (**The protein content in potatoes**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1247–60.

Tabulated data on the protein contents of a world collection of varieties are provided. To aid the breeder in selecting varieties suitable for hybridization, information is provided on other important characters of the 18 varieties with the highest protein content.

2197 Hyde, R. B. & Shewfelt, A. L.
Measurement of chipping qualities in Manitoba-grown potatoes.
Canad. J. Pl. Sci. 1960 : **40** : 607–10.

Differences are reported in suitability between ten commercial varieties for crisp manufacture. Crisp-making qualities were also affected by locality. Reducing-sugar percentage and specific gravity were reliable indexes of crisp quality. A simplified method for measuring crisp colour is outlined.

2198 Höppner, E.
Die stärkereichsten Sorten unseres Kartoffelsortimentes. (**The varieties richest in starch in our potato collection**).
Kartoffelbau 1960 : **11** : No. 1 : Stärkekartoffel 1960 : **5** : 1–2.

Characters required in industrial varieties are discussed and a survey is given of the performance in Federal Germany of 12 varieties containing at least 16% starch.

2199 Kouba, J. & Dráb, J.
Studium dýchání hlíz bramborů čs. sortimentu během uložení. (**A study on the respiration of the potato tubers of the Czechoslovakian collection during storage**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1299–1318.

Medium-late and late varieties with a high starch content respired more than early, medium-late and late varieties with less starch over the whole storage period. The early and medium-early varieties lost the greatest percentage of starch.

2200 Börger, H.
Zwiewuchs und Stärkegehalt. (**Secondary tuber formation and starch content**).
Kartoffelbau 1960 : **11** : No. 1 : Stärkekartoffel 1960 : **5** : 2–3.

Data on the secondary tuber formation and starch content of 15 varieties and lines during 1959 are provided. In some strains the starch content of the secondary growth differed from that of the primary growth and in others it was similar.

2201 Quevedo Díaz, A.
Colección de variedades y especímenes. Colección recibida de Puno. (**Collection of varieties and specimens. Collection received from Puno**).
Inf. mens. Estac. exp. agríc. La Molina 1959 : No. 113 : 24–38. (Mimeographed).

Details are provided on emergence and flowering, yield, quality and disease resistance of 68 entries in a potato collection grown in the Central Sierra region of Peru.

2202 Zadina, J.
Vzdornost odrůd čs. povoleného sortimentu bramborů proti chorobám. (**The resistance to diseases of the varieties of the Czech approved collection of potatoes**).
Za socialist. Zeměd. 1958 : **8** : 599–604.

Information is provided on the resistance of varieties to important diseases, including wart, late blight, scab and virus diseases.

2203 Baerecke, M.
Arbeitsgemeinschaft für Kartoffelzüchtung und Pflanzguterzeugung. (**The Working Party for Potato Breeding and the Production of Planting Material**).
Kartoffelbau 1960 : **11** : p. 108.

A brief report is given of some of the papers read at a meeting held in Hannover on 8–10 February 1960. Rudorf spoke on Versuch zur Frage des richtigen Aussaattermins von Kombinationen mit herausspaltenden frühreifen Sämlingen [An experiment on the question of the right sowing time for combinations with seedlings segregating for early ripening], mentioning that sowing in May gave the best conditions for selection. Ross contributed Auslese frostresistenter Wildkartoffeln [The selection of frost-resistant wild potatoes], mentioning that *Solanum acaule*, its hybrids, *S. curtilobum* and *S. juzepczukii*, and also *S. chromatophilum* and *S. multidissectum* are resistant. Foliage resistance does not parallel tuber resistance. Baerecke gave Bericht über die Isolierung von 4 Stämmen des Blattrollvirus aus verschiedenen Teilen Deutschlands [A report on the isolation of four strains of the leaf roll virus from different parts of Germany]. Ross contributed Praxis der Züchtung auf Infektionsresistenz und Immunität gegen das Y-Virus [Practice of breeding for resistance to infection and immunity to the Y virus] and made recommendations concerning the testing of resistant material. Hunnius dealt with Methodik des A_6-Testes [The method of the A_6 test]. Hofferbert contributed Erfahrungsaustausch über die Sicherheit und die Anwendung verschiedener Kartoffelteste [An exchange of experience on the reliability and application of different potato tests], discussing experiments at Ebstorf. Goffart spoke on Populationsveränderungen des Kartoffelnematoden (*Heterodera rostochiensis*) beim Anbau des nematodenresistenten Zuchtstammes 18/53 unter Berücksichtigung der Biotypenfrage [Population changes of the potato nematode (*H. rostochiensis*) on cultivation of the nematode-resistant breeding strain 18/53 with reference to the biotype question] and mentioned that the number of cysts in infected ground had been reduced by 90% by growing the strain 18/53. Stand der Arbeiten an Kulturkartoffeln mit halbierter Chromosomenzahl [The position of studies on cultivated potatoes with a halved chromosome number] was Wangenheim's topic; mention was made of the progenies with 24 chromosomes produced in the USA. Ross also contributed Über die Indianerkartoffeln Perus und Boliviens und ihre Bedeutung für die Kartoffelzüchtung [The Indian potatoes of Peru and Bolivia and their importance for potato breeding] and mentioned the qualities and disease resistance of species that he had studied in South America.

2204 Zadina, J.
Nové poznatky bramborářského výzkumu. (**New information on potato research**).
Věstn. čsl. Akad. zeměd. Věd. 1959 : **6** : No. 7 : 359–61.

Brief notes are provided on some of the breeding for disease resistance carried out at the Potato Research Institute in Havlíčkův Brod. The varieties Hindenburg, Carnea and Jubel [Jubilation] were found to provide particularly useful sources of resistance to *Streptomyces scabies*; Ostragis and Tannenburg are also good in this respect. Jubel has the disadvantage of transmitting susceptibility to internal rust spot to its progeny.

2205 Puškarev, I. I.
(The results and prospects of breeding potatoes for *Phytophthora* resistance).
Kartoffel' (Potato), Moskva 1959 : No. 5 : 28–32. [Russian].

Resistance breeding in Russia and elsewhere is surveyed. It is noted that hybrids resistant to the Korenevo, White Russian and other virulent strains occurring in the USSR have been bred. Most of these resistant forms arose in the selfed progenies of F_1 hybrids of *Solanum demissum* x *S. tuberosum*, this method showing greater promise for producing resistant varieties than back crossing, even if the cultivar concerned is resistant to *Phytophthora*. Mention is made of six clones obtained by the former method at the Potato Institute. These were greatly superior to back crosses involving Fitoftoroustojčevyj [*Phytophthora*-resistant] in resistance to the Korenevo strain. Hybrids resistant to the White Russian strain were obtained similarly at Rusinoviči in the province of Minsk. All other material which was tested there, including back crosses, succumbed to the disease. Mention is made of a recent seedling, 9170, which has so far proved resistant in White Russian trials. Also mentioned is hybrid 728–44 from Jygeva in Estonia which gave 77·7% of resistant progeny from selfing in White Russian tests, while the percentage of resistant plants from back crossing was 57–73%.

2206 Dionne, L. A.
New approaches to disease resistance from wild potato species.
Res. Fmrs., Ottawa 1960 : **5** : No. 4 : p. 10, 16.

Recent work on hybridization of *Solanum tuberosum* with wild species at the Canada Department of Agriculture Research Station, Fredericton, NB, is described. Reduction in the degree of late-blight resistance of *S. demissum*, upon back crossing *S. demissum* x *S. tuberosum* hybrids to the cultivated potato, has been found to be due to the elimination of recessive and incompletely dominant factors. Intercrossing of the hybrids to prevent this loss is precluded by the male sterility of *S. demissum* x *S. tuberosum* derivatives. It has also been established that the male sterility is due to the interaction of cytoplasmic factors from *S. demissum* with nuclear factors from *S. tuberosum*. Although it will not cross as ♂ with *S. tuberosum*, *S. demissum* can be crossed as ♂ with some diploid species closely related to *S. tuberosum*; the resulting hybrids may be selfed and intercrossed, and are crossable as males with *S.*

tuberosum. By means of such hybrids, new and higher degrees of late-blight resistance have been secured. Similar obstacles to the use of *S. stoloniferum* have been overcome in a comparable manner. Extremely early derivatives of *S. chacoense* have been obtained which have near immunity from common scab and cross readily with *S. tuberosum.* These have inherited a bitter principle from *S. chacoense* but elimination of this defect in the near future is expected. Study of the nature of the barrier to crossing between *S. tuberosum* and a group of Mexican species immune from all races of late blight has indicated how hybrids may be secured; the first of these is now being grown in the greenhouse.

2207 CICCARONE, A., BLACK, W. & BASTOS CRUZ, B. P.
Observações preliminares sôbre as raças de *Phytophthora infestans* no estado de São Paulo, Brasil. **(Preliminary. observations on the races of *Ph. infestans* in the state of São Paulo, Brazil).**
Arq. Inst. biol., S. Paulo 1959 : **26** : 177–84.

A survey in 1957–58 showed that races 4 and 1,4 were the principal races on potato and 3 and 3,4 on tomato. Races 0; 1,3,4 and 2,3,4 were present in small quantity. Racial composition was clearly influenced by host plant but geographical location had no obvious effect. All the collections belonged to the European compatibility group. From these results it appears that the *Ph. infestans* population of São Paulo is not derived directly from Mexico but is related rather to the European and N. American populations.

2208 MARKS, G. E.
Chromosome numbers in potato cultivars hypersensitive to late blight.
Euphytica, Wageningen 1960 : **9** : 254–57.

Previous work has suggested that in derivatives of *Solanum demissum* crossed and back-crossed to *S. tuberosum* blight-resistant segregates tend to be hyperploid [cf. XXII, 2040]. Among the 24 blight-resistant cultivated derivatives studied in the present work, 22 had $2n = 48$ and only two were hyperploid, with $2n = 49$. It appears that selection for agronomic characters, effected in the present but not in the earlier material, has resulted in elimination of aneuploidy and may thus usefully be introduced at the first back-cross stage in a breeding programme using cytologically unbalanced interspecific hybrids.

2209 HIŽNJAK, P. A.
(For the varietal purity of wart-resistant varieties).
Kartoffel' (Potato), Moskva 1959 : No. 5 : 37–38. [Russian].

In studies of wart-resistant potato varieties at the All-Union Potato Wart Research Station it was found that the degree of resistance of a variety changed for the better or worse in later years. Impaired resistance is attributed to the growing of the resistant variety close to a susceptible one; this is thought to provide favourable conditions for development of new virulent races of the pathogen. Soviet institutes which have bred wart-resistant varieties are listed. Also listed are 14 recent wart-resistant standard varieties, half of them of Soviet origin.

2210 La maladie verruqueuse de la pomme de terre en Europe et dans le bassin méditerranéen en 1959. **(Potato wart disease in Europe and the Mediterranean basin in 1959).**
Organ. europ. méditerr. Prot. Plant. 1960 : Pp. 10 + x. (Mimeographed).

Information from a number of European countries indicates that the incidence of new biotypes of *Synchytrium endobioticum* did not increase in 1959. Legislative measures enforced in various countries to prevent the spread of the disease are briefly mentioned.

Regarding resistant varieties, the introduction of Hassia has improved the situation in those parts of West Germany where race 6 occurs. In East Germany, the available varieties resistant to all six races are Hilla, Mira, Argo and Zeisig [Siskin]. The early variety Malchow 52.1/106 (B) is resistant to races 1, 2 and 5. The resistant variety Nowa Huta has been bred in Poland.

Über Fragen zur Züchtung nematodenwiderstandsfähiger Kartoffeln. Vorträge anlässlich eines Symposiums vom 14. bis 16. Juli 1958 im Institut für Pflanzenzüchtung Gross-Lüsewitz der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin. **(On questions of the breeding of nematode resistant potatoes. Papers presented on the occasion of a symposium from 14 to 16 July 1958 in the Institute for Plant Breeding, Gross Lüsewitz, of the German Academy of Agricultural Sciences at Berlin).**
Tagungsber. dtsch. Akad. Landwirtschaftsw. Berlin 1959 : No. 20 : Pp. 188.

2211 *Schick, R. Verbreitung und Bedeutung* *des Kartoffelnematoden und einige aktuelle Fragen bei der Züchtung nematodenwiderstandsfähiger Kartoffeln.* (*The spread and importance of the potato nematode and some topical questions in the breeding of nematode-resistant potatoes*). (*pp. 1–4*).

In this brief opening address, mention is made of progress achieved in breeding resistant potatoes and it is pointed out that very little is known of the mechanism and genetics of resistance.

2212 *Huijsman, C. A. Prüfungsmethoden zur Ermittlung der Populationsdynamik des Kartoffelälchens und der Nematodenresistenz, ihre Fehlerquellen und ihre Begrenzung.* (*Testing methods for the determination of the population dynamics of the potato eelworm and the nematode resistance, their sources of error and their limitation*). (*pp. 5–13*).

Methods of estimating the populations of eelworms in the soil and in the potato roots are critically considered.

2213 *Stelter, H. Labormethoden zur Resistenzprüfung.* (*Laboratory methods for testing resistance*). (*pp. 15–22*).

Root diffusates of resistant and susceptible forms of *Solanum tuberosum* ssp. *andigenum*, the F_1 and F_2 of subsp. *andigenum* x cultivated varieties, *S. vernei*, *S. macolae* and Aquila did not differ essentially in their effect on the hatching of nematode larvae. Mention is made of the conditions necessary for obtaining root diffusates which give comparable results. The infection of the F_1 hybrids of ssp. *andigenum* x cultivated varieties was delayed as compared with the control Aquila. Four weeks after infection the ratio of males : females was 1 : 1 in the roots of the control and 15 : 1 in the F_1 hybrids.

2214 *Nolte, H.-W. Die unterschiedliche Flächenverseuchung als begrenzender Faktor bei der Bonitierung auf Nematodenbefall der Einzelpflanze.* (*The different surface contamination as a limiting factor in the evaluation of the nematode attack of the individual plant*). (*pp. 23–31*).

The factors affecting the attack on individual plants are discussed. In the field the soil is not uniformly infected but this is not important if the plants are tested on soil with average total infection.

2215 *Sembdner, G. Über das Eindringen der Kartoffelnematoden-Larven und ihre Weiterentwicklung in pflanzlichen Geweben.* (*On the penetration of the potato nematode larvae and their further development in plant tissues*). (*pp. 53–55*).

Active larvae were brought into contact with roots and other organs of 85 species and varieties of Solanaceae. It is thought that the differences observed in the degree of infection may be determined by biochemical factors.

2216 *Toxopeus, H. J. Probleme der Resistenzzüchtung gegen* Heterodera rostochiensis *auf der Basis von* Solanum tuberosum *subsp.* andigenum. (*Problems of breeding for resistance to* H. rostochiensis *on the basis of* S. tuberosum *subsp.* andigenum). (*pp. 57–64*).

The results of investigations on the inheritance of the *S. tuberosum* subsp. *andigenum* type of resistance are described [cf. XXVI, 505 and XXVII, 4166]. A large quantity of resistant material has been built up in Holland on the basis of ssp. *andigenum* 'CPC1673' and some back crosses to cultivated varieties have been released. In spite of the occurrence of aggressive biotypes of the nematode, these resistant varieties are considered to be of great value. So far resistance to both aggressive and nonaggressive biotypes has not been found combined in one clone. Other problems connected with the breeding of resistant potatoes are also discussed.

2217 *Möller, K.-H., Rothacker, D. & Stelter, H. Stand und Methodik der Nematodenresistenzzüchtung auf der Grundlage von* Solanum tuberosum *subsp.* andigenum *in der Deutschen Demokratischen Republik.* (*The position and methods of breeding for nematode resistance on the basis of* S. tuberosum *subsp.* andigenum *in the German Democratic Republic*). (*pp. 65–81*).

Many crosses have been made between *S. tuberosum* ssp. *andigenum* and cultivated varieties having large tubers and resistance to *Phytophthora infestans* and virus degeneration; details are given of the breeding scheme. Amongst the seedling generations 50% of the clones were resistant to nematodes. The F_1 generations were analysed with respect to many important characters; 12 combinations were considered to be good. Both parental species influenced the performance of the crosses, and information is given on the combining ability of some of the forms used. The best of the new resistant clones may be ready for release as a new variety in 1961.

2218 *Zadina, J. Stand der Resistenzzüchtung bei Kartoffeln gegen den Nematoden* (Heterodera rostochiensis) *in der Tschechoslowakischen Republik.* [*The position of breeding for resistance in the potato to the nematode* (H. rostochiensis) *in the Czechoslovakian Republic*]. (*pp. 83–85*).

A brief mention is made of the testing for resistance and breeding recently started in Czechoslovakia.

2219 *Jefremenko, W. P. Einige Untersuchungen über den Kartoffelnematoden* (Heterodera rostochiensis) *in der UdSSR.* (*Some investigations on the potato nematode* (H. rostochiensis) *in the USSR*]. (*pp. 87–90*).

All the strains and varieties of potato tested were found to be susceptible.

2220 *Lechnowitsch, W. S.* [*Lehnovič, V. S.*]. *Ergebnisse der Prüfungen von Kartoffelarten auf Resistenz gegen den Kartoffelnematoden* (Heterodera rostochiensis *Woll.*). [*Results of the tests of potato species for resistance to the potato nematode* (H. rostochiensis *Woll.*)]. (*pp. 91–94*).

Amongst the species tested in the USSR, *Solanum vernei* and *S. sparsipilum* (*S. catarthrum*) and its hybrids were resistant. *S. sparsipilum* showed less resistance than *S. vernei* and some forms of *S. andigenum* but amongst its crosses with European varieties, 3% of the plants had only 1–5 cysts per metre of root.

2221 *Howard, H. W. Biotypes of potato root eelworm in Great Britain.* (*pp. 95–106*).

The first discovery of an aggressive biotype by Dunnett and subsequent survey work by Jones are described; also the method used by Jones to estimate the frequency in the soil of biotypes attacking *S. andigenum* 'CPC1673' is outlined. The possible relation between resistance-breaking and non-resistance-breaking biotypes is considered; preliminary experiments suggest that the two types do not interbreed and that resistance-breaking is recessive to non-resistance-breaking. Experiments are under way to determine how quickly resistance-breaking biotypes multiply when resistant potatoes are grown repeatedly in infested soils; in one soil there has been no increase in these biotypes after three resistant crops. Suggestions are made concerning the nomenclature of biotypes.

2222 *Dunnett, J. M. Variation in pathogenicity of the potato root eelworm* (Heterodera rostochiensis *Woll.*)*: technique and results of testing wild potatoes for resistance.* (*pp. 107–20*).

A collection of wild potatoes from South America comprising 327 clones was tested for resistance to the aggressive nematode population from Duddingston. None of the clones remained free from cysts but only a few were as susceptible as the control clones, one of which carried the gene *H* from *Solanum andigenum* 'CPC1673'. The most resistant clones were of similar morphology; they were triploid, had little or no stainable pollen and failed to set seed. Fifty-five provisionally identified wild species and species hybrids obtained from Birmingham University were also screened with the aggressive nematode population. All plants of *S. vernei* and *S. acaule* x *S. sanctae-rosae* remained free of cysts and only one cyst was observed on one of the five plants of *S. sanctae-rosae* tested; *S. sanctae-rosae* seems to compare favourably with *S. vernei* as a source of resistance. Also few cysts were found on *S. megistacrolobum* and a few other species. There appeared to be a continuous range of resistance in *S. vernei* hybrid progenies. Some crosses have been made between resistant wild species and *S. vernei* and *S. tuberosum*. In another experiment clones were tested for their reaction to both the Duddingston and Boghall nematode populations. Derivatives of *S. andigenum* 'CPC1673' and *S. famatinae* remained almost free of cysts of the Boghall population; their resistance broke down against the Duddingston population, this being most marked in the case of CPC1673. *S. demissum* and some unidentified triploid clones were more susceptible to the Boghall population than to the Duddingston population. *S. vernei* was highly resistant to both populations.

2223 *Schick, R. & Stelter, H. Das Auftreten aggressiver Formen des Kartoffelnematoden in der Deutschen Demokratischen Republik.* (*The occurrence of aggressive forms of the potato nematode in the German Democratic Republic*). (*pp. 121–29*).

Amongst 280 samples of nematodes from 56 districts tested in 1958, four populations infected hybrid progenies of *Solanum andigenum* 'CPC1685' and 'CPC1673' and a strain of *S.*

nigrum. Two of the samples infected progenies of CPC1673 but not those of CPC1685 and the *S. nigrum* strain. Eight other populations infected *S. nigrum* but not the *S. andigenum* progenies. All the other samples infected the variety Aquila and in some cases *S. nigrum* but not the *S. andigenum* hybrids. Only in a few cases were cysts found on a strain of *S. vernei.* Thus four physiological types of nematode have been distinguished. Suggestions are made concerning a test collection of potatoes for distinguishing between nematode biotypes.

2224 *Goffart, H. Einige Bemerkungen zum Problem der Züchtung nematodenresistenter Kartoffeln.* (*Some remarks on the problem of breeding nematode-resistant potatoes.* (*pp. 131–34*).

Root diffusates from various *Solanum* species differed in their effect on nematode larvae; there was no relationship between the activation of the larvae and the number of cysts developing on the roots. It is concluded that resistance does not depend directly or solely on root secretions. Cysts originating from resistant plants did not show low fertility.

2225 *Rothacker, D. Nematodenresistenzzüchtung auf der Basis von* Solanum vernei *Bitt. et Wittm.* (*Breeding for nematode resistance on the basis of* S. vernei *Bitt. et Wittm.*). (*pp. 135–57*).

A detailed account is presented of experiments carried out at Gross-Lüsewitz. The resistance genes of *S. vernei* are transferred to *S. tuberosum* in three ways. (1) Diploid *S. vernei* is crossed with diploid primitive forms such as *S. phureja*, *S. rybinii* and *S. stenotomum* and repeated back crosses are made to the primitive species; later generations are made tetraploid and crossed with *S. tuberosum.* (2) Tetraploid *S. vernei* is crossed with *S. tuberosum* and several back crosses are made to *S. tuberosum*; some of the hybrids are then crossed with each other and further back crosses made to *S. tuberosum.* (3) Diploid *S. vernei* is crossed with *S. demissum* ($2n = 72$) and the resulting tetraploid hybrids are back crossed with *S. tuberosum*; further development occurs as in (2). All progenies are tested for resistance and only the most promising are used in further crosses. Each back cross to a susceptible form decreases the proportion of resistant plants. There appear to be two main genes and a number of modifiers governing resistance.

Attempts are being made to introduce the resistant *S. microdontum* into the breeding programme; this species has been successfully crossed with *S. kesselbrennerei.*

2226 *Focke, R. Ein Versuch zur Klärung der Vererbung der Nematodenresistenz* (Heterodera rostochiensis *Woll.*) *bei* Solanum vernei. [*An experiment on the clarification of the inheritance of nematode resistance* (H. rostochiensis *Woll.*) *in* S. vernei]. (*pp. 159–62*).

The results of crosses of *S. vernei* with other forms of potato indicated that resistance to nematodes is governed by two independent dominant genes, *N* and *R*. The genotype *NnnnRrrr* confers resistance, whilst *nnnnRrrr* and *nnnnrrrr* confer low or complete susceptibility. It is not yet known whether the genotypes *NNNNrrrr* and *nnnnRRRR* are resistant.

2227 *Szulc, P. Der Stand der Forschungsarbeiten über den Kartoffelnematoden und dessen Verbreitung in der Volksrepublik Polen.* (*The position of research work on the potato nemotode and its spread in the People's Republic of Poland*). (*sp. 163–69*).

Breeding resistant varieties from *S. tuberosum* ssp. *andigenum* began in 1958 at the Institute for Acclimatization and Plant Breeding at Zamarte and breeding with *S. vernei* has now started.

2228 *Roguski, K., Niegolewski, Z. & Gramatowski, W. Einleitende Versuche an einer Kollektion von* Solanum tuberosum *subsp.* andigenum *und einigen Kreuzungen über ihre Empfindlichkeit gegenüber dem Kartoffelnematoden.* (*Preliminary experiments on a collection of* S. tuberosum *subsp.* andigenum *and some crosses on their susceptibility to the potato nematode*). (*pp. 171–74*).

Hardly any cysts were found on the clones *S. tuberosum* ssp. *andigenum* 'CPC1690 3/8' and 'CPC1673' but eight other clones and crosses including CPC1685 were not resistant. Very few cysts formed on *S. vernei.*

2229 *Kradel, J. Die Züchtung nematodenwiderstandsfähiger Kartoffeln vom Standpunkt der Pflanzenquarantäne.* (*The breeding of nematode-resistant potatoes from the standpoint of plant quarantine*). (*pp. 175–81*).

Recommendations are made for preventing the spread of nematode cysts and the formation of new biotypes.

2230 *Vorschlag zur Aufstellung eines einheitlichen Testsortimentes zur Identifizierung von Biotypen des Kartoffelnematoden und zu deren Bezeichnung.* (*A proposal for the formation of a uniform test collection for the identification and designation of biotypes of the potato nematode*). (*pp. 183–85*).

The participants of the congress recommend that a test collection of potatoes should consist of (*a*) *Solanum tuberosum* 'Aquila'; (*b*) the F_1 hybrid of *S. tuberosum* x *S. tuberosum* ssp. *andigenum* 'CPC1673' from Wageningen; (*c*) the F_1 of *S. tuberosum* x *S. tuberosum* ssp. *andigenum* 'CPC1685' from Wageningen; (*d*) *S. nigrum* from Gross-Lüsewitz; and (*e*) *S. vernei* from Gross-Lüsewitz. The nematode biotypes are to be designated by capital letters corresponding to those designating susceptible plants. Thus the common race is A, the Duddingston population ABC and the Neuhaus population ABCD. Tubers of Aquila and seeds of *S. nigrum* and *S. vernei* are available at the Plant Breeding Institute, Gross-Lüsewitz, and the tubers of CPC 1673 and 1685 at the Institute for Agricultural Plant Breeding, Wageningen.

2231 STELTER, H. & RAEUBER, A.
Untersuchungen über den Kartoffelnematoden (*Heterodera rostochiensis* Wollenweber). VII. Weitere Untersuchungen über die Veränderung einer Nematodenpopulation unter dem Einfluss widerstandsfähiger und anfälliger Kartoffelvarietäten in Topfversuchen. [**Investigations on the potato nematode (*H. rostochiensis* Wollenweber). VII. Further investigations on the change in a nematode population under the influence of resistant and susceptible potato varieties in pot experiments**].
Biol. Zbl. 1960 : **79** : 454–63.

When grown for a second year (1959) in the infested soil in which they had been grown in 1958 [cf. XXX, 545], resistant varieties reduced the number of larvae per 100 cc. of soil to a very low level but did not affect the number of cysts per 100 cc. of soil, while susceptible varieties increased the number of both. The number of larvae per cyst at the end of 1959 was 1·4–2·7% of the initial 1958 value for resistant varieties and 62·2–86·5% for the susceptible varieties. In an experiment in which a susceptible variety and four resistant varieties varying in time of maturity were grown in heavily infested soil, the early resistant variety caused a higher degree of hatching during the first few weeks, but later the values were similar for all resistant varieties. Single cysts were often found on clones regarded as resistant.

2232 HUIJSMAN, C. A.
Some data on the resistance against the potato root-eelworm (*Heterodera rostochiensis* W.) in *Solanum kurtzianum*.
Euphytica, Wageningen 1960 : **9** : 185–90.

From crosses and back crosses of the diploid *S. kurtzianum* with the diploids *S. goniocalyx* and *S. stenotomum*, it was concluded that the resistance of *S. kurtzianum* to the single population of race A tested was determined by two dominant polymeric genes. Of 42 populations of race B, which unlike A is able to attack the variety CPC1673, 35% formed large numbers of cysts on the A-resistant *S. kurtzianum* hybrids, a result which indicates that two subraces of B exist; these are provisionally designated B_1 (avirulent) and B_2 (virulent).

2233 BAGNALL, R. H. & YOUNG, D. A.
Inheritance of immunity to virus S in potatoes.
Amer. Potato J. 1960 : **37**: p. 311. (Abst.).

"Potato seedlings of different crosses were tested for resistance to potato virus S. Preliminary sap-inoculation, followed by serological testing and attempts to recover the virus on *Nicotiana debneyi* Domin. screened out the most susceptible seedlings. The survivors were grafted with infective scions of Seedling 41956 and retested for presence of virus S. Some seedlings not infected by sap inoculation, were infested by grafting, as were the 'resistant' varieties Sebago and Alpha. Seedlings free from virus S after both inoculations, and presumably having resistance equivalent to that of the 'immune' variety Saco were: Saco x Self: 29/39 (74%); Saco x Wis X 143.52: 20/148 (14%); Sdlg. 41956 x Sdlg. 96.56 (parents of Saco): 4/52 (8%); Saco x Sdlg. 96–56: 4/53 (8%); Saco x Katahdin: 1/26 (4%); Katahdin x Self 0/20; Sdlg. 96–56 x Self: 0/37. The 'immunity' appears to be controlled by more than one gene, and one, at least, seems to be recessive. 'Immunity' to virus S and 'immunity' to virus X segregated independently in the Saco x Wis. X 143.52 and 41956 x Sdlg. 96–56 crosses."

2234 KISHORE, H.

A recessive type of immunity to virus X in *Solanum tuberosum* L.

Diss. Abstr. 1960 : **20** : LC Card Mic 60–1494 : 4249–50. (Abst.).

Using X^{21}, a ring-spot strain, the mode of inheritance of reaction to virus X in the immune varieties x137 and x143 and susceptible variety AG54.55 was determined. The first two varieties were related to the immune variety S41956. The following genotypes were established: AG54.55, *aaaa Bbbb Cccc*; x143, *AAaa Bbbb CCcc*; and x137, *AAaa Bbbb Cccc* or *AAaa Bbbb CCcc*. Gene *c* in the nulliplex condition results in the hypersensitive type of resistance. *A* and *B* are complementary genes for immunity; *c* is inherited independently of *A* and *B* and does not affect their expression. Deviations from expected ratios in S_2 x 143 and F_2 AG54.55 x x143 were attributed to chromatid segregation with double reduction and to numerical non-disjunction with or without double reduction, evidence of extensive homology between the four chromosomes carrying *c* thus being provided.

2235 ALFIERI, S. A. (JUN.).

Investigations on the resistance to potato virus S in *Solanum tuberosum.*

Diss. Abstr. 1960 : **20** : LC Card Mic 60–1948 : p. 4480. (Abst.).

Saco proved to be highly resistant or immune to virus S, in serological, field, grafting and mechanical-inoculation tests. Inheritance of resistance appeared to involve "dominant-recessive-epistasis."

2236 WEINDLMAYR, J.

Wachstumszonen im Spross verschiedener Kartoffelsorten in Abhängigkeit von der Tageslänge. (**Growing zones in the sprouts of different potato varieties as influenced by the day length**).

Bodenkultur 1960 : **11** : 71–85.

The growing zone, defined as the area from the sprout tip to the point where no further cell elongation occurs [cf. XXVIII, 686], was determined in longitudinal sections of varieties differing in photoperiodic response, grown in 11-hr. days and in normal days. The length of the growing zone increased with rising day length but the difference between long and short-day plants was detectable sooner in the varieties Domino and Ultimus than in Parnassia. The increase in tuber number in the short-day plants was noticeable sooner in Augusta, in which a greater reduction in the length of the growing zone was observed, than in Urgenta. Augusta, Domino and Ultimus are thus regarded as having a short critical photoperiod. The best varieties for any given locality are those in which the critical photoperiod, above which tubers are not formed, corresponds roughly to the maximum day length of that area. Recording the time at which the difference in length of the growing zone first becomes detectable between plants growing in normal and short day respectively may provide a convenient method of determining the critical photoperiod in breeding material.

2237 MITAL, S. P., SINGH, H. B. & THOMAS, T. A.

"Pusa Lal" scores over "Pusa Safed".

Indian Fmg. 1960 : **10** : No. 5 : p. 15.

The red-skinned, white-fleshed sweet-potato Pusa Lal has given a higher yield of marketable tubers and stored better than Pusa Safed. Recommended for Delhi State and the Punjab, it also has a higher carotene content. The variety was selected from open-pollinated seedlings of a Japanese variety referred to as Norin [Ministry of Agriculture and Forestry].

2238 CARLSON, L. W. & STRUBLE, F. B.

Methods for determining the reaction of sweet potato lines to soil rot.

Phytopathology 1960 : **50** : 822–26.

A method which proved effective in testing the pathogenicity of *Streptomyces ipomoeae* isolates consisted of dipping fresh rootlets of sweet potato in a suspension of the organism and embedding them in moistened vermiculite before incubating for 5–7 days at 32° C. Resistance to *S. ipomoeae* was found to be correlated with the number of layers of nucleate periderm, resistant strains having fewer layers than susceptible ones [cf. 664]. It was also found that strains with higher rates of root development were generally more resistant than those with lower rates.

2239 NIELSEN, L. W. & POPE, D. T.

Resistance in sweetpotato to the internal cork virus.

Plant Dis. Reptr. 1960 : **44** : 342–47.

The reactions of 43 sweet-potato clones to internal cork virus are presented in tabular form. Progenies obtained by selfing the resistant variety HM15 segregated into 5 susceptible : 10 symptomless carriers : 21 resistant, suggesting that it should not be difficult to obtain a resistant variety. Progenies from the cross Porto

Rico (susceptible) x HM15 segregated into 40 susceptible: 17 symptomless carriers : 3 resistant. Possible genetic mechanisms are discussed.

FIBRES

2240 Přadné rostliny. (**Fibre plants**).
Za socialist. Zeměd. 1958 : **8** : 998–1004.
A brief account is given of the performance of some recent flax varieties [cf. XXV, 2222]. A new hemp, Šumperoká alfa [Šumperk Alpha], has been bred at Šumperk-Temenice; it yields 10–20% more fibre than local varieties.

Progress Reports from Experiment Stations, season 1958–1959.
Emp. Cott. Gr. Corp. Lond. 1960.

2241 *King, H. E. Survey of progress reports for the season 1958–59.* (*pp. 1–8*).
Work on cotton breeding and genetics is among the activities briefly surveyed.

Cotton Research Station, Namulonge, Uganda. Progress report for the season 1958–1959.

2242 *Hughes, L. C. & Walker, J. T. Plant breeding.* (*pp. 26–37*).
As in previous seasons, a selection-index technique was used to improve the yield of BP52 [XXX, 4112]. It is noteworthy that, even after selection for several generations, considerable genetic variability persists. The eleventh successive BP52 modal bulk was grown and 12MB was constituted [XXX, 2900]. An improvement in yield of about 24% over the original material is expected from 12MB. Yields of the most recent progeny bulks of BP52 also gave evidence of continued advance, improvement over the original bulk being closely in agreement with the calculated expectation of about 33%.

2243 *Walton, P. D. Cotton breeding at Serere.* (*pp. 61–73*).
Trials have indicated that the most promising variety available for issue in the Northern and Eastern Provinces is a BP52 type. The object of the short-term variety testing to be initiated in the following season is to determine the most appropriate strain or mixture of strains within this type. It has also been demonstrated that Albar stocks, which should respond to selection, offer even more promising material. Modal-bulk selection, inaugurated in Albar, BP50 and other stocks in 1956, continued.

Republic of the Sudan. Cotton Breeding Stations. Progress report for the season 1958–59.

2244 *Rose, M. F. Introductory note.* (*pp. 1–3*).
Varieties now required in the Sudan, in view of the rapid expansion of cotton production and anticipated changes in trade requirements, are discussed.

2245 *Rose, M. F., Low, A., Faulkner, R. C. & Innes, N. L. The Gezira Research Station.* (*pp. 3–21*).
In breeding Egyptian cotton, B_2B_3 S x L material gave good results in field studies and laboratory tests. This project has the following aims: increase in variability of all S and L synthetic types, production of a B_2B_3 L type equivalent in quality to X1730A, transference of the character of leaf-curl resistance from L to the S genotype, and transference of a measure of earliness from S to L in an attempt to bring "grade" back to the pre-1944 level.

Small-scale yield tests were carried out on black-arm resistant S strains (B_2B_3, B_2B_6 and $B_2B_3B_6$), L strains (B_2B_6 and $B_2B_3B_6$) and Karnak (B_2B_3), and also on Ashmouni and Montserrat Sea Island varieties.

Breeding to combine the whiteness, "loofiness", high ginning outturn and high boll weight of Tangüis with the earliness and black-arm resistance of BAR14/25 (Sakel type, B_2B_3) is under way. Four selections breeding true for black-arm resistance gave a higher lint yield than either parent and were earlier than Tangüis but not as early as BAR14/25. None of the selections equalled Tangüis in ginning outturn, boll weight, lint length or standard fibre weight. Considerable variability was however noted in each strain and it may still be possible to retain high yield and improve other characters. Black-arm resistant selections from BAR14/25 x Tangüis crossed with BAR1/16 (X1730A type, B_2B_3) and with BAR4/25 (X1730A type, $B_2B_3B_6$) are also being studied.

In American-cotton breeding, progress was made towards developing a variety equal in yield to BAR7/8 and to BAR11/7 in quality, as shown by results from derivatives of BAR11/7 x Hopi Acala, BAR7/8 x Hopi Acala, BAR11/7 x Wilds SUS16/1 and BAR7/8 x BAR11/7 [XXX, 2902].

B_6 has been transferred to BAR11/7 (B_2B_3) and 22 strains homozygous for $B_2B_3B_6$ were tested for yield and quality, with encouraging results.

2246 *Dark, S. O. S. & Saunders, J. H. Shambat Station.* (*pp. 21–27*).
B_2, B_3, B_2B_3 and B_6 gave no protection against the boll phase of *Xanthomonas malvacearum*, but B_2B_6, $B_2B_3B_6$, B_4 and B^9 conferred a high degree of resistance.

It has been decided that in new transferences it will be more advantageous to use B_2B_6 than

$B_2B_3B_6$. This transference to Ashmouni 34, BAR11/7, Acala 4.42 and Pima S1 is being effected as quickly as possible, in view of increasing demand for diversification of types. Synthesis of new combinations of B genes in pairs is proceeding. In the heterozygous state, the combination B_2B_4, either with or without B_6, is the only one to give enhanced resistance, as judged by leaf-lesion grading. Strains of standard varieties of composition b_2B_6 are being synthesized. Transference of B_1, B_5 and B_7 to *Gossypium hirsutum*, for use in homology tests, is receiving attention. Investigation of B factors transferred from *G. herbaceum* to Sakel continued.

Basic studies on the genetics of hairiness continued [XXX, 2903].

BAN lines, a Sakel series stemming from BAR14/25 x *G. auritum* and having increased ovule number per locule, showed promise as material for selection, chiefly with respect to white lint colour, ginning outturn, lint index, seed number and lint yield.

Hybrids between *G. anomalum* and *G. triphyllum* were futher studied. Progress was made in transferring the closed boll of *G. herbaceum* 'Wagad 8' to a tetraploid commercial cotton. If this transference is successful, a new type for mechanical picking may result. Transference of black-arm resistance from *G. anomalum* is being attempted. *G. incanum*, a new species from the Aden Protectorate, has been successfully crossed with *G. somalense*, *G. areysianum* and *G. stocksii*. It is thus almost certainly a member of the E-genome group, as is also indicated by its morphology. *Notoxylinon australe* was successfully crossed with *G. sturtii*. Transference of high lint strength from *G. thurberi* has been discontinued, because the character is multigenic and no practical method of maintaining it in a commercial variety is available.

2247 *Rose, M. F., Low, A. & Hannay, H. E. Kadugli Station.* (*pp. 27–34*).

The results of variety trials in the Nuba Mountains, central rainlands and Equatoria are reported.

2248 *Munro, J. M. Nyasaland. Progress report for the season 1958–59.* (*pp. 1–12*).

Replacement of CLB by Albar 637 continued [XXX, 2905]. Single-plant selections of Albar 637 and related Albar strains were tested for yield. Work on crosses of Albar 51 with the best bacterial-blight susceptible varieties reached the F_2 stage.

Northern Nigeria. Progress report for the season 1958–59.

2249 *King, H. E., Lawes, D. A. & Lee, B. J. S. Cotton breeding.* (*pp. 3–5*).

Reselection within Allen stocks was mainly concerned with a single strain which originated from the same material as Samaru 26J. This strain shows promise of a further advance in yield but is below 26J in average lint length [XXX, 2906]. Reselection of hybrid material, including that produced by the panmixis method, continued.

Tanganyika Territory, Eastern Province. Progress report for the season 1959.

2250 *Smith, R. & Cross, J. E. Plant breeding and agronomy.* (*pp. 3–10*).

Advances were realized in all the major characteristics required in an improved cotton, viz. higher yield, jassid resistance and ginning outturn, with maintenance of lint quality at its present level. Combinations of improved strains will be tested in the following season in multiline lots for possible issue. Use is now being made of a selection index for yield, based on bolls per plant, seed number per boll and lint per seed. The pedigree method of selection has resulted in greatly improved strains, but it is considered that soon few further major advances may be expected through its application. The selection index technique will thus become increasingly important as a means of securing subsequent minor progressive improvements.

Tanganyika Territory, Lake Province. Progress report for the season 1958–59.

2251 *Arnold, M. H. & Brown, K. J. Cotton breeding.* (*pp. 6–7*).

The material under study consists of 8/290 derivatives, Albar hybrids, and hybrids in which B_{6m} has been added to Ukiriguru strains and Albar hybrids, the immediate objective being the development of commercial varieties highly resistant to bacterial blight.

2252 *Arnold, M. H. & Arnold, K. M. Bacterial blight.* (*pp. 8–13*).

Assessment of the increase in yield to be expected from the highly resistant hybrid Albar E21/15/504 under conditions of varying degrees of bacterial-blight attack was attempted. The hybrid gave a slightly better yield than Uk51 in the virtual absence of blight and produced a crop worth 49% more than Uk51 when blight was present in all its phases throughout the growing season, the increase being due partly to increase in yield and partly to decrease in the proportion of grade C seed. Investigation of the inheritance of blight resistance in Albar hybrids and strains originating from Local continued.

Kenya, Nyanza Province. Progress report for the season 1958–59.

2253 *Hastie, M. S.* (*pp. 1–6*).

The possible replacement of S47 by successive multiline strains of BP52 developed at Namulonge, Uganda, is under consideration.

Aden Protectorate. Research Section, El Kod. Progress report for the season 1958–59.

2254 *Anthony, K. R. M. Plant breeding.* (*pp. 5–7*).

Tests carried out at the Shirley Institute, England, provided information on the degree of variability in fibre strength to be expected within selected progenies. Tested in comparison with Wilds Early and K1 (first bulk filter of the Sudan importation BAR XL1), BC_5 material (R1) showed a good degree of resistance to Abyan root rot [XXX, 2907]. Back crossing of resistant selections to K1 continued.

2255 *Spence, J. R., Cave, C. T., Charles, W. B. & Archibald, M. A. The West Indies. Cotton Experiment Stations. Progress report for the season 1958–59.* (*pp. 1–18*).

Progeny-row selection of Montserrat Sea Island, VH8 and VH10 and filtering of the main Sea Island strains for resistance to *Fusarium* wilt continued.

2256 CARVALHO, M. DE

Experimentação algodoeira. Resultados de alguns ensaios. (**Cotton experimentation. Results of some trials**).

Rev. Biol. 1958 : 209–60; Mem. Trab. Cent. Invest. cient. Algod. No. 28.

Yield trials in five localities in Moçambique and observations on fibre quality are reported for nine strains. Special promise attaches to strains A455 and A618.

2257 [**The results of the All-Union conference on the breeding and seed production of cotton. (A summary report of the conference)**].

Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 13–16. [Russian].

Measures for the improvement of cotton breeding, recommended at a conference in Taškent in June 1959, are outlined. Mention is made of recent varieties, characterized by earliness, high yields, fineness of fibre, good lint length and high ginning percentage. Details of new varieties and the breeding methods employed are given in the papers summarized below [2258–60].

2258 [**The present position and measures for improvement of cotton breeding and seed production. (A summary of reports and addresses at the conference, separately for the republics)**].

Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 17–27. [Russian].

Cotton breeding in Uzbekistan, Tajikistan, Kirgizia, Turkmenia, Kazahstan, Azerbaijan and Armenia is surveyed. Mention is made of new varieties which however are said to be in most cases inferior to the older standard varieties. Recent cultivars from Azerbaijan include 2421, characterized by earliness, large bolls, compact habit, high yield and good lint length.

2259 [**New effective methods of breeding and seed production of cotton. (A summary of reports and addresses at the conference)**].

Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 28–45. [Russian].

A. D. Dadaev described the Mičurinist and other breeding techniques by which Soviet cotton breeders were able to obtain many new varieties distinguished by earliness, large bolls, high yields and ginning percentages, good lint length, fineness of fibre and resistance to *Verticillium*, *Fusarium* and *Xanthomonas*. One variety from Fergana has fuzzless seed and requires no defuzzing, while some interspecific hybrids have coloured lint and are resistant to diseases. A. I. Avtonomov dealt with quality breeding and advocated greater reliance on the tested older methods such as single-plant selection. The Mičurinist technique of intravarietal crossing proved valuable in improving the vitality and lodging resistance of 108F; sterile forms, previously found in this variety, have now disappeared. V. P. Krasičkov described a series of new varieties, including interspecific hybrids of *Gossypium hirsutum* x *G. barbadense*, from Tajikistan. Most are fine-fibred cultivars with determinate branching, large bolls, good technological properties, short growth periods, high yields and high ginning percentages, and some are resistant to cotton wilt, fungous root rot and *Macrosporium*. I. K. Maksimenko discussed the breeding methods employed in Turkmenia. Varieties bred in recent years include Ashabad 2, with good breaking length of fibre and other useful technological properties; also mentoned are Tašauz 25 and 143, which are 10–15 days earlier than 108F without being inferior to it in other economic characteristics. N. P. Samojlov reported on cotton breeding in south Kazahstan and described the mentor effects which foreign pollen produces on interspecific and multiple hybrids. These effects include (1) unusual combinations of characters in hybrid progeny, (2) segregation in the F_1, (3) constancy of many forms in the F_2 and (4) dominance of the cultivated types. K1893 and K1916 were obtained in this way. The former is 12–15 days earlier than 108F and has a 50% higher yield before the onset of frosts. The other variety is productive and early and has large bolls and fibre with technological properties superior to those of other early cottons. I. M. Veliev gave an account of Mičurinist training for earliness in Azerbaijan, where varied temperature treatments of the seed and repeated early sowing were the chief methods employed. L. A. Turks reported on cotton breeding at Fergana. Heterosis, interspecific hybridization, segregation and the relations between inheritance on the one hand and parental forms and the breeding methods employed on the other were among the topics discussed. A recent variety with fuzzless seed and two others that are resistant to wilt have been bred. Ju. Hodža-Ahmedov reviewed cotton breeding in Kara-Kalpakia and described KK2056 and other recent cultivars interesting for earliness, large bolls and high yields and ginning percentages. Reference is made to a few early cultivars from Taškent which have bolls weighing 7 g., a ginning percentage of 40% and a fibre length of 35 mm. under the growing conditions of Kara-Kalpakia. S. A. Mustafaev discussed Mičurinist methods of seed production including directed training for earliness, large bolls and increased lint length, and also mentioned the improvement of vitality of the breeding material by intravarietal crossing. V. G. Kulebjaev gave an account of breeding fine-fibred cottons at Iolantan', where combined vegetative and sexual hybridization has given good results. New cultivars include I37 and I58 which are characterized by earliness, high yield, fineness of fibre, large bolls, good lint length and fibre strength. Wilt-resistant varieties 8981I, 9122I and 9123I were bred.

2260 Varuncjan, I. S.
[Some problems of cotton breeding in the USSR. (A summary of the report)].
Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 45–47. [Russian].

Soviet breeders are criticized for breeding and multiplying too many mediocre varieties without completing the advanced stages of selection. The result is that hardly any new variety bred in the last ten years equals 108F in yield and fibre quality or exceeds it in ginning percentage and earliness; S4727 (137F x S1470) is among the few new cultivars satisfactory in these repects, but it is susceptible to wilt. Crossing 108F with 1298 or 2173 and back crossing the hybrids to 108F is thought to be a promising method for obtaining the required type.

2261 Quintanilha, A.
Viagem de estudo aos Estados Unidos e ao Canadá. (**A study tour in the United States and Canada**).
Mem. Junt. Invest. Ultramar 1959 : No. 14 : Pp. 109; Mem. Trab. Cent. Invest. cient. Algod. No. 37.

A detailed account is given of the author's visits to cotton research institutes in the USA and to the International Genetical Congress at Montreal in 1958. Special attention is devoted to cotton breeding.

2262 **Progress report on the annual varietal and environmental study of fiber and spinning properties of cottons, 1959 crop.**
US Dep. Agric. 1960 : No. CR–41–59 : Pp. 71.

Tabulated information is presented on the results of tests on commercial varieties and experimental material grown in the USA during 1959.

2263 Justus, N. & Leinwebr, C. L.
A heritable partially male-sterile character in cotton.
J. Hered. 1960 : **51** : 191–92.

The symbol *ms*–1 is proposed for a recessive gene for partial male sterility, found in a population of Upland cotton at Paradise, Okla. Environmental conditions influenced sterility expression to some extent. The possible utilization of the gene in the production of hybrid cotton seed is discussed briefly.

2264 Dark, S. O. S.
Plant hairiness and staple length in cotton.
Emp. Cott. Gr. Rev. 1960 : **37** : 266–69.

H_2, which controls the pubescence characteristics of *Gossypium tomentosum* and mutant T611 of *G. hirsutum*, was found to be independent of lint-shortening effects when transferred by back crossing to *G. barbadense* 'Domains Sakel' and its black-arm resistant derivatives at Shambat, Sudan. The difference between this finding and the results reported by Simpson [cf. XVIII, 329] may be reconciled by considering that in the author's investigations the original cross in each case was made between the short-linted pubescent variety and a long-linted variety in which this property is probably conditioned by a large number of mainly dominant genes balanced in the genotype through intensive selection over a considerable period. By the fifth back cross the genotype is largely restored to the balanced long-lint type, plus H_2.

2265 Ramey, H. H. (Jun.)
Evidence for gene interactions in the inheritance of lint length in upland cotton (*Gossypium hirsutum* L.).
Genetics 1960 : **45** : p. 1007. (Abst.).

Data on lint length were obtained from the F_1 and F_2 of a cross of Half and Half with Delfos 9252 and from the parents. Average lint lengths in inches were: Half and Half, 0·88; Delfos 9252, 1·08; F_1, 1·19; F_2, 1·18. Biometrical analysis indicated that deviation of the F_1 mean from the midparental value and deviation of the F_2 mean from the mean of the F_1 and midparental value were not due to chance alone. This suggested the possibility of both allelic and nonallelic interactions.

2266 Justus, N.
Residual heterozygosity in a variety of Upland cotton as measured by Micronaire, lint percent, percent first harvest, and yield of lint.
Agron. J. 1960 : **52** : 555–59.

An analysis was made of residual heterozygosity in an open-pollinated variety (Stoneville 62) developed in Oklahoma, the characters measured being Micronaire for value of fibre fineness, lint percentage, earliness as indicated by percentage contributed by the first harvest to the total weight of seed cotton, and lint yield. Data were obtained from S_1s of 50 plants of Stoneville 62, an inbred tester derived from the variety Washington, and 50 F_1 progenies from crosses of the 50 plants of Stoneville 62 with the inbred tester. For interpreting the data it was postulated that if heterozygosity persisted in Stoneville 62, the rank of variances would be $\sigma^2 S_1 > \sigma^2 F_1 > \sigma^2$ inbred. The estimates of genetic variability were made by substracting the total variance of the tester from the total variance of each S_1 progeny, this difference being assumed to be genetic. Evidence was obtained that the open-pollinated variety had not reached homozygosis for any of the characters studied. The variety was however probably close to genetic equilibrium for all four characters. Heterozygosity was randomly distributed among the plants.

2267 Božinov, M. M.
(Heterosis in cotton and the possibilities of its utilization in practice).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.) Sofija 1959 : **8** : 229–51. [Bulgarian].

Sixty-one interspecific hybrids obtained from crosses involving eight varieties of *Gossypium hirsutum* and five of *G. barbadense* showed marked F_1 heterosis in growth, boll formation, yield, fibre length and, in some instances, earliness. The fibre was close in type to Egyptian cotton. The strongest heterotic effect was seen in *G. hirsutum* '2367' x *G. barbadense* '5904', which had 35–36 mm. fibre and good early maturation ability and outyielded its parents by 22–98%. The F_2 hybrids were poor in yield and quality.

Artificial pollination of emasculated flowers gave 83–91% hybrids, while artificial pollination of nonemasculated flowers gave 21·37% hybrids after one pollen application and 35–50% after two.

2268 Khanna, R. C.
An experimental study of quantitative inheritance in cotton.
Indian J. Genet. 1959 : **19** : 134–49.

A detailed account is provided of investigations which have been briefly reported elsewhere [cf. XXX, 4111].

2269 Walker, J. T.
The use of a selection index technique in the analysis of progeny row data.
Res. Mem. Emp. Cott. Gr. Corp. 1960 : No. 37 : 81–107.

[Cf. XXX, 4112].

2270 **New long staple, Pima S–2, released.**
Progr. agric. Ariz. 1960 : **12** : No. **3** : p. **14**.

The cotton Pima S–2 (Pima S–1 x Pima 3–79) has been relased in Arizona, New Mexico and Texas.

2271 Waddle, B. A.
Registration of improved cotton varieties.
Agron. J. 1960 : **52** : p. 658.

Recently registered by the US Department of Agriculture in cooperation with the American Society of Agronomy, Dixie King (formerly Bobshaw 44) and Austin [XXVIII, 723] are described.

2272 Brown, C. H.
Ashmouni and its variates.
Emp. Cott. Gr. Rev. 1960 : **37** : 270–73.

Information is given on the history of the Egyptian cotton Ashmouni and its selections, together with a discussion of their technological properties.

2273 Saunders, J. H.
The wild species of *Gossypium*. IV.—World distribution and evolutionary history.
Emp. Cott. Gr. Rev. 1960 : **37** : 258–63.

With reference to the literature and some unpublished observations, the author discusses the above topics [cf. XXX, 4117]. Botanical descriptions of *G. herbaceum* race *africanum* and *Notoxylinon australe* are also given. It is regarded as almost certain that central Africa was the centre of origin of the genus, at a time when the now discontinuous areas occupied by *G. anomalum* in a belt across Africa south of the Sahara and in Angola were in all probability contiguous. In addition to the distribution of this species, the discovery of *G. longicalyx* in Tanganyika and Uganda and a herbarium record of its collection in the Sudan provides another piece of evidence, albeit fragmentary, linking the northern and southern areas of distribution of the genus in Africa. Further attempts to hybridize *G. longicalyx* with other genome-E species with which it has been tentatively grouped have however failed [cf. XXX, 561]. In the author's view, the present occurrence of wild species in central America with genome D and in Australia with genome C finds an acceptable explanation in terms of Wegener's theory of continental drift. As regards the origin of the modern New World cottons, he finds the hypothesis put forward by Hutchinson, Silow and Stephens acceptable [cf. XVIII, p. 183]. Consideration is however given to the other possibility that an ancestral A cotton of south Africa at one time overlapped the distribution of the ancestral D type in that part of west Africa which joined the American continent before continental drift, so that opportunity for hybridization between them was provided, the resulting allopolyploid being isolated in central America at the time of the parting of the continents. In view of the fact that no surviving A-genome species exists on the American continent, this possibility is thought to be remote. The interrelationships and speculative evolutionary history of the genus are set out diagrammatically. It is suggested that the ancestral stock from which the genus arose was itself polyploid, possibly a combination of species with respectively $x = 6$ and 7. In particular, published and unpublished data on the genetics of chlorophyll deficiency in diploid and tetraploid species provide some support for this view.

2274 Sastry, G. R. K. & Swaminathan, M. S.
Chromosome associations in haploid *Gossypium barbadense*.
Curr. Sci. 1960 : **29** : 398–400.

In each of the 100 PMCs examined in a single haploid ($2n = 26$), the chromosomes were all univalents. A single microsporocyte had 26_{II}. Nondisjunction during premeiotic mitosis could have led to the formation of such a cell. At diacinesis and metaphase, specific secondary associations of the end-to-end, side-to-side and end-to-side types were observed. The associations noted involved 1 large and 1 small univalent, 2 large and 1 small, 3 large and 1 small or 3 large univalents. The occurrence of secondary association between large and small chromosomes is interpreted as being indicative of homology between a few of the A and D-genome chromosomes, while the secondary association of large chromosomes only is regarded as providing support for the view that chromosomes belonging to genome A have undergone a higher degree of duplication than those of B, as suggested by the observations of Kammacher *et al.* [Cf. XXVIII, 1866].

2275 Meyer, J. R. & Justus, N.
Potential value of doubled haploids in cotton.
Genetics 1960 : **45** : p. 999. (Abst.).

Variability tests have shown that colchicine-doubled haploids are more uniform than ordinary open-pollinated varieties. Agronomic tests have indicated that the best doubled haploids of American Upland cotton equal commercial varieties in lint quality and yield and do not necessarily have narrow ranges of adaptation. Doubled haploids are being used as recurrent parents in interspecific transferences. They also hold promise as an aid in the purification and maintenance of commercial varieties. Doubled haploids and their derivatives would be valuable as parents in the production of F_1 hybrids.

2276 Arutjunova, L. G.
[Brief results and future aims of the genetic investigations with cotton. (A summary of the report)].
Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 47–50. [Russian].

This account of Mičurinist studies on pollination and fertilization includes the following results. Pollination with a large amount of foreign pollen stimulated enzyme activity and carbohydrate metabolism in the sexual elements, thereby accelerating the fertilization process and improving the vitality of the progeny. The amount of carbohydrates in the ovules of cross-pollinated cotton was 1·5 times higher than in self-pollinated ovules. Large amounts of self pollen increased seed sets without any improvement in the vitality of the progeny such as was observed in the progeny of plants pollinated with mixed pollen from other plants of the same variety. The ratios of hybrids and maternal types in the progeny from intervarietal hybridization with mixed pollen, including maternal pollen, depended on the times of emasculation and pollination, the fertilizing ability of the maternal variety and the position of ovules in the ovary. Intervarietal pollination without emasculation gave a high percentage of hybrids when carried out at 8–9 hr., but more hybrids were obtained from the pollination of emasculated flowers by mixtures of equal parts of the two components during the period from 12–15 hr. The latter period was also the best for producing a greater number of interspecific and other distant hybrids. Intervarietal hybridization with a pollen mixture including pollen from the mother plant or other plants of the maternal variety gave in the first case mostly hybrids and in the second predominantly maternal types. The use of pollen from other plants of the maternal variety produced more marked and more lasting heterotic effects than pollen from the mother plant. The highest percentage of hybrid seed is formed in the basal ovules of the ovary. Useful results have been obtained by supplementing the pollen of the ♂ parent with pollen from distantly related species such as kenaf. The method is used for the improvement of vitality, boll weight, ginning percentage and fibre quality in heterotic intravarietal hybrids, or for the production of interspecific hybrids with the characters of the maternal parent, which are normally more productive and uniform morphologically than the corresponding F_1 from open pollination. Hybrids between American and Egyptian cotton obtained in this way gave rise to fertile progeny and formed a greater number of seed capsules per plant. A hybrid between American and Peruvian cottons gave rise mostly to forms with a perennial habit, 80% of the F_2 having monopodial and only 20% sympodial fruiting branches. All hybrids formed up to three capsules. After the F_1 had been pollinated with the pollen of Acala cotton and pollen of a distantly related species it gave rise to hybrids resembling Acala and hybrids with the maternal characters in the recessive condition. A high percentage of the resultant hybrids had sympodial branches and an increased number of seed capsules per plant. Environmental training of hybrids, vegetative rapprochement and photoperiodic treatments are also mentioned as methods used successfully for shifting the inheritance towards the one or the other parent. Incompatibility in wide crosses is overcome by the combined effects of vegetative rapprochement and mixed pollination. The breeding of hybrids of *Gossypium arboreum* ♀ x *G. hirsutum* ♂ possessing the characters of the ♂ parent gave good results when supplementary pollination or back crossing were employed. The fertility of hybrids between species with 26 and 52 chromosomes was improved by grafting or ringing the hybrids and using the 52-chromosome plant as ♂ parent. Chromosome doubling by means of colchicine also proved effective. Another technique of overcoming incompatibility between species with a different chromosome number is the use of an interspecific hybrid in place of one of the parent species. For instance, the F_1 of *G. herbaceum* x *G. arboreum* crosses more readily with *G. hirsutum* than the individual components of the F_1 hybrid, and develops 5–20% hybrid seed. A very high percentage of successful interspecific crosses is obtained when a 52-chromosome tetraploid obtained by doubling the chromosome set of the F_1 of (*G. herbaceum* x *G. arboreum*) is used as one of the parents. The amphidiploid gives rise to 70–80% hybrids after open pollination with New World cottons having 52 chromosomes. Meiotic studies of (*G. herbaceum* x *G. arboreum*) x *G. hirsutum* or x *G. barbadense* respectively showed that fewer than the expected 25 bivalents and from 4 to 6 univalents were formed. By growing these hybrids in 10 hr. days their fertility was restored and the inheritance of the hybrids was shifted towards the New World cotton. The production of interspecific hybrids which have paternal characteristics but are nevertheless thought to arise apomictically is of interest. This kind of hybrid has been obtained by pollinating oriental cotton with pollen mixtures of different botanical varieties of American and Egyptian cotton. The hybrids breed true, have 52 chromosomes and are distinguished by high yield, earliness and a high rate of synthesis of cellulose in the fibre. Morphologically they resemble *G. hirsutum.*

2277 Iyengar, R. L. N.

Technological reports on standard Indian cottons, 1958.

Technol. Bull. Indian Cott. Comm. : Ser. A 1959 : No. 99 : Pp. 107.

This bulletin provides a report of fibre, yarn and spinning tests on 22 varieties chosen as standards from the 1957–58 and previous crops [cf. XXX, 573].

2278 Iyengar, R. L. N.

Technological reports on trade varieties of Indian cottons, 1958.

Technol. Bull. Indian Cott. Comm. : Ser. A 1959 : No. 100 : Pp. 94.

The results of the fibre, yarn and spinning tests of about 30 varieties are given for the 1957–58 season, together with those of tests for the previous four seasons [cf. XXIX, 4134].

2279 Islam, A. S. & Imam, M. M.

Position of *Gossypium bakeri* Watt in the systematics of cotton.

Biologia, Lahore 1959 : **5** : 41–44.

Senra incana, collected from Thana Bulla Khan, proved to be morphologically identical with *Gossypium bakeri*. Because of this, and the chromosome number $2n = ca.\ 36$ found in *S. incana*, which differs from the numbers found in Old and New World cottons, it is considered that *G. bakeri* should be merged with *S. incana*.

2280 Brodie, B. B. & Cooper, W. E.

Reaction of differential cotton varieties to isolates of *Xanthomonas malvacearum* in North Carolina.

Plant Dis. Reptr. 1960 : **44** : 800–01.

All of 16 *X. malvacearum* isolates collected from the major cotton-growing counties of North Carolina reacted as race 1 on the differential varieties Stoneville 2B, Stoneville 20 and Mebane B1. Some variation in virulence was noted but this was considered to be quantitative rather than qualitative.

2281 Wiles, A. B.

Evaluation of cotton strains and progenies for resistance to *Verticillium* wilt.

Plant Dis. Reptr. 1960 : **44** : 419–22.

Using a seedling-inoculation technique, varieties and strains of *Gossypium hirsutum*, *G. barbadense*, *G. arboreum*, *G. harknessii*, *G. herbaceum* and *G. klotzchianum* were evaluated for resistance to *V. albo-atrum*. Strains of *G. arboreum*, *G. barbadense* and *G. herbaceum* were highly resistant while *G. harknessii* and *G. klotzchianum* strains were susceptible. Certain of the *G. hirsutum* strains were highly resistant in the seedling stage but less so as mature plants. Surviving plants of six *G. hirsutum* varieties were selfed and the resulting progenies screened for resistant seedlings; these have been further selected. Good resistance was found in the progenies of the *Fusarium*-resistant Alabama Hybrids 56–4M, 257–202 and 81–4. Resistant lines selected from the F_1 of a *G. barbadense* x susceptible *G. hirsutum* cross are being used in breeding.

2282 Borisov, G.

(The breeding of wilt resistant cotton varieties).

Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 62–63. [Russian].

This review of a pamphlet on breeding fine-fibred cottons resistant to *Fusarium* at Iolantan' in Turkmenia mentions 9123I, which is highly resistant and has fibre of superior quality to the standard 8763I. It is thought, however, that the productivity and boll size of this and also of some other new varieties should be improved before introduction.

2283 Verderevskij, D. D.

(The question of breeding cotton for resistance to diseases).

Hlopkovodstvo (Cotton Growing) 1959 : No. 9 : 52–53. [Russian].

An account is given of resistance breeding at the Moldavian Institute of Plant Protection, in particular the breeding of cottons resistant to *Xanthomonas* and *Verticillium*. Single plant selection among susceptible varieties grown under conditions of artificial infection is the chief method employed. Mention is made of forms immune from *Xanthomonas* which were selected from such cultivars as 611B, Od1, 108F, 3521U and 6466U.

2284 Brodie, B. B., Brinkerhoff, L. A. & Struble, F. B.

Resistance to the root-knot nematode, *Meloidogyne incognita acrita* in Upland cotton seedlings.

Phytopathology 1960 : **50** : 673–77.

Resistance to root-knot nematodes in cotton seedlings appeared to be associated primarily with necrosis of the invaded rootlets. Larvae entered resistant roots as readily as they did susceptible roots, but, in a fairly large proportion of the resistant seedlings, galls and egg-laying females were not produced. Discoloured roots with slight swellings and larvae arrested in the early stages of development probably indicate an intermediate type of resistance. It is concluded that disease reaction can be determined fairly accurately in 16 days, using the presence of dead roots and the absence of normal galls as criteria of resistance.

2285 **Cottons that starve insects.**
Agric. Res., Wash. 1960 : 9 : No. 5 : 3–4.
Upland varieties with no extrafloral nectaries or with a reduced number are being developed in the USA with a view to exploring the possibility of controlling nectar-feeding insects by means of such cottons. *Gossypium tomentosum* is being used as source of the character of absence of extrafloral nectaries.

2286 **Seed bulletin. Fibre flax.**
IVRO, Wageningen 1960 : Pp. 8.
Descriptive notes and yield data are presented for six varieties recommended in the Netherlands and five varieties not yet admitted to the Netherlands varietal list.

2287 Sizov, I. A.
(**Pledge of success in breeding and seed production of flax**).
Agrobiologija (Agrobiology) 1959 : No. 5 : 768–70. [Russian].
The success of breeding improved flax varieties is said to be assured by Mičurinist methods, based on the Darwinist principle of geographical variability. Studies of variability in economic characters and of environmental conditions which induce heritable changes have been carried out at the Institute of Plant Industry. New high-yielding forms of flax with increased length of stems, improved fibre quality and larger seed have been obtained by utilizing the theory of phasic development for directing changes.

2288 Helbaek, H.
Notes on the evolution and history of *Linum*.
Kuml 1959 : 103–20; also in Danish 120–29.

Evidence is assembled in support of the hypothesis that the large-seeded summer-annual *Linum* of dynastic Egypt and the small-seeded winter-annual flax from the Swiss Lake Dwellings were two ecologically adapted derivatives of the Near Eastern race of *L. bienne.* The conclusion is based mainly on measurements of seed imprints from Iraq, from which the occurrence of two lines has been established, one associated with irrigated land and showing a progressive increase in seed size and the other associated with conditions of natural precipitation and having a maximum seed length of 4·03 mm. The latter is postulated to have moved to central Europe via the Danube basin and thence to western Europe. Late Bronze Age evidence from Denmark however indicates the presence there of two *Linum* strains, one of which appears to have been introduced from the east. Measurements of carbonized linseed from a Polish site of approximately the same period are in agreement with the Danish figures and prompted the speculation that one branch of the "European" *Linum* may have moved northward from its place of origin in the Near East to Russia and thence to eastern Europe.

2289 **Annual Report of the Jute Agricultural Research Institute (1957–58).**
Indian cent. Jute Comm. 1959 : Pp. 118.
Investigations at the Jute Agricultural Research Institute and at allied stations are reported.
Rice. In an 8-variety paddy trial, Patisal gave the highest yield of grain, closely followed by Sitasal and Jhingasal. As regards straw, the highest yield was obtained from Sitasal followed by Patnai, Bhasamanik and Dudkhani.
Jute. Indigenous and exotic collections of *Corchorus capsularis* and *C. olitorius* were selected. Progeny-row trials of both species were carried out, a total of 1472 progenies being carried foward for further studies. A number of varietal trials conducted at the institute and on cultivators' plots are reported. Progenies resulting from intervarietal crosses have been selected and carried forward. Successful interspecific hybridization between the above two species was achieved by using a new technique; this appears to have overcome the incompatibility barrier previously reported [cf. XXVIII, 3220]. Breeding for resistance to *Macrophomina phaseoli* has continued. Preliminary studies have indicated that seed size in the crumpled leaf mutant of *C. capsularis* is larger than in the normal type; however, the seed yield per plant is lower in the mutant.
In the cytogenetics section, seeds resulting from crosses between *C. aestuans* x *C. capsularis* and *C. tridens* x *C. aestuans* all failed to germinate. Attempts to cross *C. capsularis* with *C. siliquosus* and *C. olitorius* with *C. siliquosus* were unsuccessful. A number of seeds obtained from diploid x polyploid and polyploid x polyploid crosses have been carried forward.
Urena. F_1 plants derived from crosses between *U. sinuata* and *U. lobata* all died. A further 32 successful crosses between the two species were carried out.
Hibiscus. Further indigenous collections of *Hibiscus* spp. were received. Many secondary selections of *H. cannabinus* and *H. sabdariffa* were made. The interspecific hybridization programme, involving the above two species

and *H. radiatus*, continued. A number of different methods of pollination were used in attempts to overcome incompatibility between *H. sabdariffa* and *H. cannabinus* and a total of 23 out of 500 crosses proved successful. Studies have continued on the inheritance of anthocyanin pigmentation in *H. sabdariffa* and of earliness in *H. cannabinus*.

2290 Banerjee, S. P. & Datta, R. M.
Studies on the cytogenetical basis of incompatibility in the two cultivated jute species (*Corchorus olitorius* Linn. and *C. capsularis* Linn.)—II.
Indian Agric. 1960 : **4** : 5–18.

A cytological study of postpollination development in crosses between *C. olitorius* and *C. capsularis* has been carried out in an attempt to elucidate the problem of incompatibility between these species. It was found that pollen tubes succeeded in fertilizing only very few ovules in the maternal parent; these ovules were situated in the upper part of the ovary, while almost all the ovules in the lower portions of the ovary collapsed or degenerated owing to nonfertilization. It is suggested that the growth of the pollen tubes was inhibited by some substance or substances present in the style of the other species. Differences in style length exist between the two species but the current study indicated that this factor was not responsible for incompatibility. The formation of endosperm was found to be irregular in the few cases where fertilization was successful. The endosperm appeared to contain haploid, diploid and triploid nuclei [cf. 689].

2291 Patel, G. I. & Datta, R. M.
Cytogenetical investigations of X-ray induced mutations in jute (*C. capsularis* Linn. and *C. olitorius* Linn.).
Nucleus, Calcutta 1960 : **3** : 125–34.

Seeds of the two species were exposed to doses ranging from 1000 to 40,000 r. A cytological study was made of the following modifications: (1) a mutant branch of an X_1 plant of *Corchorus capsularis*, flowering earlier and having flattened stems and small roundish leaves, (2) a fasciated X_1 plant of *C. olitorius*, and (3) an X_2 mutant derived from (2), which flowered 15 days earlier than the control and had large drooping flowers and more succulent stems than usual. In (1) and (2), different combinations of quadrivalents, bivalents and fragments were observed, the quadrivalents possibly being due to reciprocal translocations. Stickiness and bridge-fragment associations were noted in (2). Pollen stainability was only 4% in (1) but 90% in (2). Meiosis was almost normal in (3). This mutant was quite fertile and is to be used in breeding. Its useful characters are its early flowering and the comparative ease with which it may be retted because of its softer stem.

2292 Basudev Ray
Natural crossing in *Corchorus olitorius* L.
Indian Agric. 1960 : **4** : 1–4.

The extent of natural crossing in *C. olitorius* has been determined in a trial at the Jute Agricultural Research Institute, Barrackpore, West Bengal. In the population studied, the percentage natural crossing varied from 3·3% to 17·7%, the mean being in the region of 10·5%.

2293 Pandey, K. K.
Incompatibility in *Abutilon* 'Hybridum'.
Amer. J. Bot. 1960 : **47** : 877–83.

A. 'Hybridum' refers to a group of cultivars which have arisen through hybridization between several *Abutilon* species, particularly between *A. darwinii* and *A. striatum*. It has been found to have a one-locus multiallelic gametophytic system of self incompatibility of the *Nicotiana* type, five *S* alleles having been distinguished. The incompatibility behaviour in many crosses was however modified by genes nonallelic to the *S* locus. In view of the origin of *A.* 'Hybridum', it is suggested that its diverse polygenic background is not adjusted to the proper functioning of the *S* system. Although most of the plants in the six groups studied were highly self incompatible in the early and middle part of the season, many showed pseudo-self-compatibility later on. Colchicine-induced autotetraploidy led to partial or complete self compatibility.

After incompatible pollination, pollen germination appeared to be normal but most of the tubes were inhibited in the stigma. Tubes penetrating the style usually burst, this being a phenomenon not previously found in any other species with a gametophytic system of self incompatibility.

2294 Kenaf, investigaciones conducidas en Cuba. (**Kenaf, investigations conducted in Cuba**).
Bol. Estac. exp. agron. Cuba 1959 : No. 74 : Pp. 280.

The results of investigations conducted between 1943 and 1957 are presented. Studies of meristematic cells in floral buds failed to reveal the presence of any polyploid forms. The percentage of natural crossing in six varieties was found to vary between 2 and 24% approximately.

Different methods of vegetative propagation are discussed, as well as the techniques used for artificial self pollination and hybridization. Successful crosses between *H. cannabinus* and *H. diversifolius* are reported. Inheritance studies showed that divided leaf is dominant to entire leaf.

A number of new lines, derived by selection from the variety El Salvador, have lengthened the maturity period of the crop, thus easing harvest pressures. Possibilities for future development of hybrid lines are briefly discussed. Details are given of the origin, maturity date, yielding capacity, morphology and disease resistance of the varieties currently being grown in Cuba. It has been noted that plants susceptible to certain diseases such as anthracnose are also most susceptible to attack by *Meloidogyne incognita.* Attempts are now being made to breed nematode-resistant lines; use is being made of the resistant species *H. asper. H. cannabinus*, which is resistant to *Phytophthora parasitica*, has been crossed with *H. sabdariffa* var. *altissima* with the aim of producing a resistant variety of the latter species. The red-stemmed variety Java is rather susceptible to *Pellicularia filamentosa* and has been crossed with resistant lines of the El Salvador type. Resistance to this disease is apparently governed by a simple Mendelian factor, resistance being recessive. *H. asper, H. costatus, H. abelmoschus, H. diversifolius* and *H. esculentus* are all resistant to *Colletotrichum hibisci* while *H. sabdariffa* and *H. sabdariffa* var. *altissima* are susceptible. Varieties of *H. cannabinus* introduced from Peru, Java, Formosa, Korea and Manchuria are more susceptible than is the downy-stemmed, green El Salvador type. A number of crosses involving these species and varieties are reported. The progeny of all crosses involving *H. diversifolius* were found to be totally resistant. The F_1 of crosses between *H. asper* and *H. cannabinus* were also resistant but thus far have failed to yield any fertile seed. Resistance to anthracnose is apparently governed by *Vv*, effective during both vegetative and reproductive phases, and *Ff*, effective only during the reproductive phase. The effects of these genes are cumulative and in both cases susceptibility is incompletely dominant to resistance. Thus during the vegetative phase, the following genotypes are postulated: resistant, *vvFF, vvFf* and *vvff*; susceptible, *VvFF, VvFf* and *Vvff*; and very susceptible, *VVFF, VVFf* and *VVff.* However in some species of *Hibiscus*, dominant immunity to anthracnose appears to exist and it may prove possible to introduce this factor into kenaf by hybridization. A physiological mechanism for resistance to the pathogen is suggested; it is based on the ability of tissues of *H. cannabinus* to maintain an acidic reaction at a time when fungal secretions are alkaline in nature.

2295 Ghosh, T. & Sanyal, P.
Behaviour of the hybrid progeny from a cross between *Hibiscus cannabinus* Linn. and *H. radiatus* Linn. against some common diseases of the former.
Indian Agric. 1960 : **4** : 18–22.

H. radiatus is resistant to the following diseases: tip rot, caused by *Trichosphaeria* sp.; stem rot, caused by *Corynespora* sp. and *Helminthosporium* sp.; and root rot, caused by *Rhizoctonia bataticola.* Resistance to these diseases has been transferred to the progeny of a cross *H. cannabinus* x *H. radiatus* made at the Jute Agricultural Research Institute, Barrackpore, West Bengal.

2296 **Annual Report of the Tanganyika Sisal Growers' Association, Sisal Research Station, Mlingano, Ngomeni, for the year 1958** : Pp. 36.

Some of the more promising selections from *Agave amaniensis* x *A. angustifolia* are being multiplied for yarn-strength tests. Further crosses were made among F_1 and F_2 material.

2297 **Annual Report of the Tanganyika Sisal Growers' Association, 1959–1960** : Pp. 74.

Hybrid 11648 from *Agave amaniensis* x *A. angustifolia* [cf. XXVIII, 751], although still outyielding *A. sisalana*, has not lived up to its earlier promise; in the trials reported it was outyielded by hybrid 487.

2298 Singh, H. B. & Joshi, B. S.
A pleiotropic recessive gene affecting lobing of leaf and stigma in *Luffa acutangula.*
Indian J. Genet. 1959 : **19** : 234–35.

An off-type of Pusa Nasdar with increased leaf lobing and single instead of bifid stigmatic lobes was due to the pleiotropic effect of a single-gene recessive mutation.

SUGAR AND STARCH PLANTS

2299 **Annual Report of the Sugarcane Breeding Institute, Coimbatore for 1956–57.** 1959 : Pp. 108.

Many new promising Co. canes, as well as some introductions such as CP49/50, M63/39, Q49 and Q50, were used in crossing. The crosses included a number made for the purpose of breeding varieties resistant to diseases and pests. Synchronized flowering of certain early and late-flowering canes was achieved through photoperiodic treatments. Sixty seedlings (Co. 1172–Co. 1231) were raised to the status of Co. canes and distributed to state testing stations.

Adjacent-row crossing made possible by proper designing of the arrowing plot was successful. A modification of the marcotting method of isolation of stalks for crossing has given good results during the past few years, and appears to be a satisfactory alternative to the sulphurous-acid technique. The moist soil used as rooting medium is wrapped with polythene.

The possible role of *Erianthus maximus* and *Saccharum robustum* in the evolution of *S. officinarum* was investigated. According to data on number of seedlings obtained from crosses, *E. maximus* has greater compatibility with *S. robustum* than with *S. officinarum*. The *S. officinarum* clone Manjri Red was, however, an exception. It is noteworthy that this clone has given seedlings even when pollinated by maize, teosinte, *Coix* and *Sorghum durra*. Experimental evidence of parthenogenesis in Co. 602 ($2n = 118$), with or without chromosome elimination, has already been obtained. Its breeding behaviour when crossed with *S. spontaneum* ($2n = 64$) and *S. robustum* ($2n = 64$) has now been studied. Transmission of *S. spontaneum* characters was clearly discernible but evidence of the transfer of those of *S. robustum* was less strong; these observations were corroborated by data on chromosome numbers in the progenies.

Occurrence of tannin in the root tips of all forms of *Erianthus* examined and its absence in related genera would appear to offer a useful additional means of distinction.

A case of the contribution of a reduced egg by *S. officinarum* 'Vellai' in a cross with *S. spontaneum* ($2n = 120$) is reported. This is of considerable interest in view of the fact that hitherto only unreduced eggs of *S. officinarum* have been found to function with haploid gametes from *S. spontaneum* ($2n = 56, 64, 80$ or 112).

In work on *S. spontaneum* collections, spikelet length was found to be partly related to geographical distribution, the variants examined falling into nine geographical groups on the basis of this character and ancillary floral characters. Chromosome numbers of 67 more variants were determined. Selfing of this species was initiated to develop lines pure-breeding for certain characters, high sucrose content and resistance to red rot (*Physalospora tucumanensis*) being chosen for a start. Epidermal structure was investigated in 50 more variants. Nearly 100 crosses were effected to assess the breeding value of accessions of *S. spontaneum*.

2300 **Annual Report of the Sugarcane Breeding Institute, Coimbatore for 1957–58.** Pp. 104.

Forty-two seedlings (Co. 1232–Co. 1273) were given Co. status. Besides many crosses among *Saccharum officinarum* varieties and accessions, *S. spontaneum* canes were crossed with Co. and other varieties, to develop parental material. Inbreeding of *S. spontaneum* to produce lines pure-breeding for important characters continued. Hybridization between *S. officinarum* and *S. robustum* was resumed. SH598 (*S. robustum*) was successfully crossed with the former species without much reduction in juice quality, although the seedlings lacked vigour. Attempts are being made to impart vigour by crossing the seedlings with varieties involving *S. spontaneum* in their origin.

S. officinarum 'Manjri Red' and 'Chittan' were crossed as ♀ parents with P' 601/2 ($2n = 96$), a derivative of *S. spontaneum*. The seedlings resembled *S. officinarum* in Brix value and stalk thickness. They were classified into seven groups with respect to the latter character. Each group had $2n = 128$, indicating that unreduced ♀ gametes had functioned. The seedlings appear to offer the possibility of yielding commercial types by further nobilization. Synthetic forms of *S. spontaneum* with $2n = 52$ were produced by crossing variants with $2n = 40$ and $2n = 64$. Morphological resemblance between the synthesized forms and naturally occurring ones with $2n = 52$ was striking.

Crosses attempted between *S. officinarum* and teosinte yielded a few seedlings but whether these are hybrids remains to be ascertained. Some seedlings were also secured from crosses of *Sorghum durra* with maize. In all the progenies from crosses of *S. officinarum* or *S. robustum* with *Sclerostachya*, *Narenga* or *Erianthus*, the fourth glume was invariably present, indicating dominance of this feature, which is a characteristic of the last three genera. *S. spontaneum* was successfully used as ♀ in crosses with *Narenga*, *Sclerostachya* and *Erianthus*. With SES184A and SES248 as the *S. spontaneum* parents, only reduced eggs functioned whereas, with *S. spontaneum* 'Coimbatore', unreduced eggs entered into fertilization.

As judged by the number of hybrid seedlings obtained, *E. maximus* and *S. spontaneum* are highly compatible.

E. maximus 'Raiatea' and 'Duruku Viko Damu' had $2n = 60$ and $2n = 96$–100, respectively. On the basis of floral characters and the absence of tannin in the root tips [cf. 2299], however, the validity of assigning these two varieties to *E. maximus* is questioned.

Detailed study of the floral characteristics of *S. spontaneum* variants has been completed. Investigations on flowering behaviour in this species indicated that the displacement of a clone per latitudinal degree resulted in a change of 2·4 days in flowering, positive for northerly and negative for southerly displacement. With the determination of chromosome numbers of 26 more variants, the chromosome survey of *S. spontaneum* is practically complete, covering the whole known area of distribution of the species. A further 92 crosses were effected to determine the breeding value of *S. spontaneum*. Experiments on the effects of ionizing radiations were initiated.

Proceedings of the Third All India Conference of Sugarcane Research and Development Workers, Pusa (Bihar), October, 1957. Part II. Papers presented, speeches and other details.
Indian cent. Sugarcane Comm. 1957 : Pp. v + 421.

2301 *Sharma, S. L., Srivastava, R. C. & Sharma, S. K. Studies in the wild* Saccharums *of Bihar: evaluation of some outstanding forms. (pp. 13–23).*

Observations on the economic characters of 17 forms of *S. spontaneum*, one of *S. robustum* and 8 of *Erianthus arundinaceus* were made at the Central Sugarcane Research Station, Pusa, Bihar. Forms considered to be of potential value in breeding programmes are as follows: *S. spontaneum*, N29, N27, N34, N6, N30; and *E. arundinaceus*, WS5, N12, N18, WS1, WS2.

2302 *Venkataraman, N. R. Studies on the lodging of sugarcane in north Bihar. Morphological and anatomical features relating to lodging. (pp. 24–28).*

A morphological and anatomical study of six sugar-cane varieties indicates that a combination of several factors, rather than any single character, predisposes a variety to lodging. On the basis of this study, BO.11 and Co.513 are classified as erect, BO.21 and Co.313 as "slightly lodging" and BO.10 and Co.453 as lodging varieties.

2303 *Rao, J. T. Sugarcane breeding in different countries. (pp. 30–40).*

Breeding work in Australia, Fiji, the West Indies, Hawaii, Indonesia, Mauritius, Mexico and the Philippines is described. Methods employed in Australia and Hawaii are compared with those currently in use at the Sugarcane Breeding Institute, Coimbatore.

2304 *Babu, C. N. Studies in* Saccharum spontaneum. *(pp. 44–46).*

Data on the chromosome number of 41 African and Asian variants of *S. spontaneum* show that low numbers predominate in the central part of the eastern hemisphere, an area which includes north India, East Pakistan and Nepal. To the west and east of that region, high chromosome numbers are predominant. It appears that "in the evolution of *spontaneum* variants, (1) increase in chromosome numbers through polyploidy, as well as (2) reduction in the chromosome numbers perhaps through natural crossing and chromosome elimination are met with".

2305 *Raghavan, T. S. & Kandaswami, P. A. Breeding behaviour of Co. 421 in relation to its cyto-genetics. (pp. 46–51).*

Co.421 was used as the pistillate parent in crosses with the Coimbatore and Glagah lines of *Saccharum spontaneum*. Cytological studies showed that the progeny were genuine hybrids; this is the first time hybrids have been produced from crosses in which Co.421 was the female parent. Progeny obtained from other crosses in which Co.421 was involved were generally of parthenogenetic origin. Cytogenetic aspects of these results are discussed.

2306 *Rasool Batcha, M. B. G. & Kandaswami, P. A. Chimera and the probable origin of bud sports in sugarcane. (pp. 51–57).*

Information is provided on the occurrence and origin of unicoloured sports from striped canes, of striped canes from nonstriped canes and of white stripes on leaves during certain stages of growth.

2307 *Negi, O. P., Mishra, D. N. & Khanna, K. L. Studies on flowering in wild* Saccharum. *(pp. 58–64).*

Tabulated data are provided on the main floral characters, including flowering period, of 48 wild forms of species related to sugar cane. The time of arrowing of *S. robustum* and forms N18 and WS7 of *Erianthus arundinaceus* synchronized with that of sugar cane.

2308 *Sastry, S. K. Relative performance of some Coimbatore canes in Hyderabad State.* (*pp. 77–87*).
The results of varietal trials in Hyderabad are reported. Co.467, which proved to be consistently superior to the widely grown variety Co.419, has now been released. The new variety has the same maturation period as Co.419; its ratooning capacity is fairly good. Co.527, an early-maturing variety, has also been released. This variety is suitable for early crushing in October and November.

2309 *Butani, D. K. & Khanna, K. L. Resistance of different varieties of sugarcane to the attack of whitefly.* (*pp. 311–14*).
Observations on the incidence of *Aleurolobus barodensis* on 11 varieties of sugar cane at the Central Sugarcane Research Institute, Pusa, indicate that Co.313, Co.513, BO3 and BO21 are comparatively resistant to this pest.

2310 *Harbans Singh, Sardul Singh & Nand Singh. A review of sugarcane diseases in the Punjab.* (*pp. 326–29*).
Studies at the Sugarcane Research Station, Jullundur, Punjab, showed that Co.453, Co.421 and Co.L9 are moderately resistant to red rot, *Physalospora tucumanensis.* In another test, 11 varieties were artificially inoculated with smut, *Ustilago scitaminea*; no disease symptoms were observed in two varieties, S261/50 and Co.617.

2311 *Rafay, S. A. & Singh, V. B. The role of red rot lesions on mid-ribs.* (*pp. 335–38*).
Information is provided on the distribution in Bihar and Lucknow of the light and dark races of *Colletotrichum falcatum* (*Physalospora tucumanensis*).

2312 *Rafay, S. A. & Singh, V. B. Pathogenicity of red stripe organisms.* (*pp. 342–43*).
Differences have been observed in the virulence of Lucknow and Bombay isolates of *Xanthomonas rubrilineans* on the sugar-cane variety Co.S510.

2313 *Kirtikar & Singh, D. R. Recent studies on sugarcane smut in Uttar Pradesh.* (*pp. 344–51*).
Observations on the incidence of smut (*Ustilago scitaminea*) in Uttar Pradesh show that the varieties Co.527 and Co.K30 are less infected by the disease than other varieties.

2314 *Chenulu, V. V. & Srinivasan, K. V. Observations on the rust affecting* Erianthus arundinaceus *at Coimbatore.* (*pp. 356–59*).
No symptoms of rust (*Uredo ravennae*) were found in 23 out of 38 varieties of *Erianthus arundinaceus.* Rust did not affect any varieties of *E. munja, E. ravennae, E. longisetosus, E. hookeri, E. fulvus* or *E. elephantinus.*

Annual Report of the Mauritius Sugar Industry Research Institute, 1959 : Pp. 102.

2315 *George, E. F. Cane breeding.* (*pp. 31–42*).
The effect of various light treatments on flower initiation is being studied with the aim of (*a*) inducing flower formation in varieties which do not normally flower freely, and (*b*) delaying flowering in early-flowering varieties for crossing purposes. A series of parallel crosses made in the field and in the greenhouse are summarized. Fertility was superior in crosses effected indoors, except in the case of Ebène 1/37 x M147/44; the difficulty of preserving Ebène 1/37 stalks in solution without wilting is stressed. Emasculation experiments using the hot-water method were not successful; where emasculation was effective, stigmas and ovaries were also adversely affected and no seedlings were obtained from crosses involving heat-treated flowers. Notes are given on the performance of promising new varieties under various environmental conditions. Varieties M202/46 from Co.281 x M63/39 and M93/48 from Ebène 1/37 x M63/39, are being released commercially.

2316 *Rochecouste, E. Weed control.* (*pp. 67–71*).
Four biotypes of *Cynodon dactylon*, comprising triploids and tetraploids and differing in reaction to spraying with TCA and Dowpon, have been identified in Mauritius. Tetraploids were generally more resistant than triploids to damage by these chemicals.

Congrès Sucrier 1960. (**Sugar Congress, 1960**).
Rev. agric. sucr. Maurice 1960 : **39** : 161–340.

2317 *Rouillard, G. Les dommages causés aux cannes par cyclones Alix et Carol.* (*Damage caused to canes by the cyclones Alix and Carol*). (*pp. 174–81*).
On the basis of a study of the damage caused by cyclone Alix in Mauritius, the following sugar-cane varieties are classified as resistant; M147/44, M134/32, M305/49, R397, M93/48, B3337 and B37172. Details are given of damage caused to certain varieties by cyclone Carol. The possibilities of breeding for cyclone resistance are discussed briefly and a number of suggestions are made for future investigations. [Cf. XXIX, 4161].

2318 *Lauffenburger, G. La lutte contre la maladie de fidji de la canne à sucre à Madagascar.* (*The struggle against Fiji disease of sugar cane in Madagascar*). (*pp. 198–219*).

The relative resistance of a large number of sugar-cane varieties to Fiji disease is currently being investigated. The biology of *Perkinsiella saccharicida*, the only known vector of this virus disease, is also under study.

2319 *D'Emmerez de Charmoy, D. Un aspect imprévu de la gommose à la Réunion.* (*An unexpected aspect of gummosis in Réunion*). (*pp. 229–36*).

After a long absence, bacterial gummosis, possibly caused by an introduced strain of *Xanthomonas vasculorum*, has reappeared on sugar cane on the island of Réunion. Many previously resistant varieties have become infected but M134/32, R445, R447, Vesta, B41–227 and Co.419, all of which are derived from POJ2878, continue to show resistance. A number of recent crosses which have shown partial resistance are listed [cf. XXX, 4143].

2320 *George, E. F. Factors affecting the initiation of flowering in sugar cane.* (*pp. 328–40*).

Studies on the induction, retardation and inhibition of flowering are reviewed.

2321 **Twenty-fifth Annual Report of the British West Indies Central Sugar Cane Breeding Station, Barbados for the year ending 30th September, 1958** : Pp. 44.

Detailed information is given on the numerous crosses made in the period under review and on the results of trials of seedlings derived from the earlier series of crosses. Apart from an increase in the use of introductions and recently developed B varieties as parents, crossing followed the same general lines as those of the two previous years. Extensive use was made of "area crosses", in which several females are pollinated by a single male.

The results of inbreeding to date are briefly surveyed. Three distinct aspects are being investigated: (1) crossing between related parents, (2) top crossing, using selfs as males with proven ♀ varieties, and (3) development of selfed lines homozygous for certain characters. Some findings which refute arguments against inbreeding are mentioned, as follows. (*a*) Selfing does not necessarily result in loss of vigour. Particularly in the early generations of selfing, some populations have equalled or surpassed outcrosses in general vigour. (*b*) Arrowing is not related to vigour but is controlled genetically. (*c*) Self and ♀ sterility have not been of frequent occurrence. (*d*) Evidence has not been obtained of postmeiotic parthenogenesis in inbreds, and even if it does occur, would not be viewed as a drawback. In general, previous findings on maintenance of high juice quality in inbred lines were corroborated. The merits of inbreeding and outbreeding cannot yet be compared however, since inbred parents have so far been used only on a small scale and their seedling progenies have not passed the second-year stage of trial. Preliminary results suggest that use of inbreds in top crosses is worthy of continuance.

The nature of ♂ sterility in B37161, one of the standard ♀ parents, was investigated. Meiosis was highly regular, with $50\text{–}54_{II} + 0\text{–}8_{I}$. Sterility was attributed to breakdown in the maturing pollen grains.

Some progress was made in developing a satisfactory root-tip squash technique.

Chromosome losses with successive selfings appeared to be the rule rather than the exception in lines developed from interspecific aneuploid parents, but at present it is not possible to state which chromosomes are lost or whether there is any regular pattern in the loss.

Preliminary experiments on the hot-water technique of emasculation gave encouraging results, using the highly ♂-fertile B3337 and B4098.

2322 **Twenty-sixth Annual Report of the British West Indies Central Sugar Cane Breeding Station, Barbados for the year ending September 30th, 1959** : Pp. 46.

Detailed information is provided on the numerous crosses made in the period under review and on the results of trials of seedlings derived from earlier series of crosses. Varieties which have shown promise in the B54' series trials are B5401, B5480 and B54142. Six select-seedling trials comparing B49119 with standard varieties were concluded. The new variety performed well and is now being grown commercially.

Further selfings were made in lines being developed from B3337, B34104, B35276, B4098, B41211 and B44234. A new line was started from B43235, a promising *Saccharum officinarum* - *S. spontaneum* - *S. barberi* hybrid. Several inbred crosses and top crosses were made with the object of testing combining ability. In the top-cross programme, inbreds are used primarily as males, since the great majority of them shed abundant pollen of normal appearance. Of the 171 selfed clones which arrowed during the 1958 season, 144 (more than 84%) were male fertile. This ratio was much higher than for the outcrossed varieties of similar derivation in the main breeding plots, where roughly 50% of the 400 breeding varieties were male fertile. The high percentage of male-fertile clones in the inbred series is considered to be the result of the automatic selection for meiotic regularity which takes place in successive generations of selfing. Although most selfs arrowed more heavily than commercial varieties, crosses involving them did not show heavier arrowing than crosses from the general breeding programme.

A study on methods of seedling selection was carried out. There were indications that selection on the basis of the extent of tillering in pots would be useful where some reduction of numbers was necessary between the potting and field nursery stages. This procedure is probably superior to Finney's random discard method [cf. XXVIII, 3728].

In further emasculation studies, 2,2-dichloropropionic acid was sprayed on to leaves and sheaths of standing cane of B41227 shortly before arrow emergence. Most arrows dried off before setting seed and were inviable when a 1% solution was used. The optimum time-temperature balance for the Hawaiian heat treatment appeared to be 48° C. for six minutes. However, no seedlings have yet been raised from heated arrows. It is pointed out that satisfactory emasculation by one treatment will probably be achieved in only a portion of the arrow, since the remainder of the flowers will not be at the critical stage of development.

2323 Matherne, R. J., Stafford, T. J. & Hebert, L. P.
Results of sugarcane variety tests in Louisiana during 1959.
Sug. Bull., N. Orleans 1960 : **38** : 290–300.

The highest-yielding varieties on light soils were CP 51–21, 53–1 and 44–101. The latter has been the leading commercial variety in Louisiana for several years. On heavy soils, the best yields were obtained from NCo.310, CP52–68 and CP44–101. The results also indicated that CP48–103 is the best available variety for early milling purposes.

2324 Henderson, M. T.
Breeding in sugarcane with special reference to kinds of material.
Sug. Bull., N. Orleans 1960 : **38** : 320–22.

In a brief account of sugar-cane breeding, particular reference is made to the origin of varieties now in cultivation in Louisiana. It is suggested that the incorporation into breeding programmes of wild forms of *Saccharum spontaneum* known to occur in India, Burma and Sumatra might be of value.

2325 **1959 report of the Experiment Station Committee of the Hawaiian Sugar Planters' Association.** Pp. 80.

Preliminary results from a physiological and biochemical study of ten varieties is reported. Information is provided on differential growth responses to age and N applications, and on the N, P and K contents of the varieties. Progress in identifying varieties resistant to downy mildew, ratoon stunting disease, red rot (*Physalospora tucumanensis*) and leaf scald (*Xanthomonas albilineans*), is outlined. Work has continued on the inhibition of flowering by N-(4-chlorophenyl)-N′,N′-dimethylurea and on its induction by means of controlled photoperiodic treatments.

2326 **Bureau of Sugar Experiment Stations. 59th Annual Report of the Director to the Hon. the Minister for Agriculture and Stock, Brisbane, Queensland 1959** : Pp. 103.

Sugar cane. Hybridization and selection continued at the various stations [cf. XXX, 607]. Trials on marcotting are reported; it was found that German peat moss was the most effective rooting material. At the Northern Experiment Station, the application of maleic hydrazide successfully delayed flowering in N.Co.310 and Eros but some other varieties were unaffected. Studies designed to indicate the most profitable selection rate were carried out; the optimum technique appears to be the interpolation of a 4-sett plot between the original seedlings and 30-sett plots. A new method of naming selections is described. Q67, which has been approved for the Burdekin mill areas, has shown high early sugar and resistance to lodging. Q68 produces well on very poor soils and has been approved for the mills of the central district. A vigorous Indian variety, Co.475, was approved for the Mossman, Mulgrave and Babinda areas. Details are given concerning extensions in the range of approval for other varieties, and varieties which will be approved in 1960 are listed. The seedlings N654 and N685 have shown resistance to leaf scald, *Xanthomonas albilineans*.

Cowpea. Breeding work continued at the Northern Sugar Experiment Station. Families which gave good performances were Havana x

Black Eye 5, Havana x Malabar, Malabar x Black Eye 5 and Malabar x Buff.

2327 Dunckelman, P. H.
Report on sugarcane breeding at Canal Point, Florida, 1959–60 season.
Sug. Bull., N. Orleans 1960 : **38** : 273–76.
Particular attention has been paid to the induction of flowering in nonflowering sugarcane varieties. A method is described which resulted in improved flowering in CP29–320, CP53–76, CP50–40, Cl. 47–83, Co. 290, Caña Blanca [White Cane] and D74. In certain varieties, e.g. CP29–320, and on certain soils, e.g. sand and custard-apple muck, the incidence of flowering was greater in canes infected with ratoon stunting disease (RSD) than in healthy canes. It may be advantageous in some instances to use RSD-infected canes in breeding programmes.
A large number of high-quality seedlings have been produced from crosses designed to yield varieties with resistance to mosaic and other diseases.

2328 Abbott, E. V.
Dedication of memorial to William Elliott Jones.
Sug. Bull., N. Orleans 1960 : **38** : 266–68.
The contributions of W. E. Jones in the development of improved, disease-resistant varieties of sugar cane are noted.

2329 Buzacott, J. H.
A vigorous hybrid sugar cane.
Cane Gr. quart. Bull. 1960 : **24** : 69–70.
By crossing *Saccharum robustum* '51N.G.140' (♀) from Papua with POJ2878, a hybrid (53B45) much more vigorous than either parent has been obtained at the Meringa Station, Queensland. It may prove useful in breeding, provided a sufficient amount of its vigour is maintained in back crosses with commercial types.

2330 Shang, K. C., Chu, S. S., Weng, T. S. & Li, H. W.
Cytological studies of sugarcane and its relatives. XVI. Further studies of basic chromosome number of *Saccharum officinarum* L.: F_1 hybrid of Vellai and *Sclerostachya fusca* A. Camus.
Bot. Bull. Acad. sin. 1960 : **1** : 23–27.
Meiotic observations are reported on the F_1 clone ($2n = 55$) of *Saccharum officinarum* 'Vellai' ($2n = 80$) x *Sclerostachya fusca* ($2n = 30$) which was used for the initial back cross referred to in the previous paper in this series [cf. XXX, 2944]. The modal configuration at metaphase I was $20_{II} + 15_{I}$, indicating complete autosyndesis of the 40 chromosomes derived from sugar cane. Most of the *Sclerostachya* chromosomes were noticeably larger than those of sugar cane. Some of the chromosomes from sugar cane occasionally failed to form bivalents, the maximum number of univalents being 25, together with 15_{II}, as seen in 2 out of the 100 PMCs examined. The maximum number of bivalents formed by *Sclerostachya* chromosomes was 2, in 2 PMCs. The maximum number of trivalents, presumably consisting of two sugarcane chromosomes and one from *Sclerostachya*, was 2, in 1 PMC. A single quadrivalent, attributed to association of sugar-cane chromosomes, was found in 13 cells.

2331 Hughes, C. G.
A new sport in Q50.
Cane Gr. quart. Bull. 1960 : **24** : 49–50.
A sport of Q50 developed alternating zones of cream and green, the loss in chlorophyll preventing it from growing as well as the normal canes.

2332 Khanna, K. L., Sharma, S. L. & Srivastava, R. C.
Outstanding canes of Bihar V—B.O.17. A morphological study.
Indian J. Sugarcane Res. Developm. 1960 : **5** : 9–16.
Information is given on the pedigree, morphological features and field and industrial performance of the sugar-cane variety BO17 (Co. 331 x Co. 326) [cf. XXX, 609].

2333 **Some varietal characteristics of the more important commercial varieties.**
Sug. Bull., N. Orleans 1960 : **38** : 310–12.
The following varieties of sugar cane are described; CP44–101, NCo.310, CP36–105, CP44–155, CP48–103, CP36–13, CP47–193, CP43–47 and CP52–68. The degree of resistance to borers, red rot and mosaic is recorded for each variety.

2334 Guilbeau, W. F., Coll, E. E. & Martin, L. F.
Milling and processing characteristics of C.P.51–21, compared with commercial varieties C.P.44–101 and N.Co.310.
Sug. Bull., N. Orleans 1959 : **38** : 70–71.
The unreleased variety CP51–21 had a much higher fibre content and a slightly lower sucrose extraction than either of the commercial varieties.

2335 ETHIRAJAN, A. S.
Anatomical peculiarities of two interesting clones of *Saccharum officinarum* L.
Curr. Sci. 1960 : **29** : 396–97.

Observations are reported on the anatomy of 51NG121 and 51NG131 from New Guinea, respectively characterized by short lop-sided internodes interpolated at intervals between normally developed internodes, and by oval internodes.

2336 VIJAYALAKSHMI, U. & ETHIRAJAN, A. S.
Stem epidermal pattern of pubescent culms in certain clones of *Saccharum officinarum* L.
Curr. Sci. 1960 : **29** : 400–01.

The normal stem-epidermal pattern in *S. officinarum* is made of long cells in straight rows and interspersed groups of short "cork" and "silica" cells. In the clones Pelo de Moca, RG Ventre, Lehu 75, 51NG89 and NC32, long, unicellular and vacuolar hairs developing from the walls of the silica cells were present, in addition to the long and short cells. In the highly pubescent clones, over 60% of the silica cells were transformed into hairs and the long cells were unusually short. It is suggested that this unusual type of stem-epidermal pattern is suitable for genetical study.

2337 VIJAYASARADHY, M.
Study of the tissue reaction to low temperatures and the assessment of frost resistance in sugarcane.
Indian J. Sugarcane Res. Developm. 1960 : **5** : 49–53.

In investigations on 24 Co. canes, 9 *Saccharum spontaneum* clones, 2 POJ varieties and 1 north-Indian type at the Sugarcane Breeding Institute, Coimbatore, Madras, varietal differences were found in the effects of treating (1) single-bud setts and (2) sett shoots six to eight weeks old for five days at 3°–5° C., the *S. spontaneum* canes exhibiting the greatest susceptibility. The change in osmotic concentration of the cell sap was determined in sett plants exposed to a temperature of 3°–5° C. for 120 hr. at the age of 5–6 weeks. Using $CaCl_2$ as the plasmolysing agent and neutral red as the stain to indicate incipient plasmolysis in the pith and chlorenchyma, varietal disparities were detected in the change in osmotic concentration, as indicated by the difference between the maximum value recorded for a variety at the end of the treatment and the corresponding control value. Canes in which the change after 120 hr. ranged from (*a*) 0·12 to 0·15 M, (*b*) 0·07 to 0·11 M and (*c*) 0·03 to 0·06 M were considered to be resistant, moderately resistant and susceptible to cold, respectively.

2338 SRINIVASAN, K. & RAO, J. T.
Certain adaptive characters of genetic stalks of *Saccharum spontaneum* L. tolerant to water-logged conditions.
Curr. Sci. 1960 : **29** : 321–22.

Out of 28 clones of *S. spontaneum* tested at the Coimbatore Sugarcane Breeding Institute, two clones, SES334 and SES340, were found to perform best under waterlogged conditions. They were characterized by the production of a large network of fibrous roots and a number of negatively geotropic roots coming to the water surface. It is suggested that these two clones may serve as suitable genetic donors of tolerance of waterlogged conditions in the breeding of sugar-cane varieties. The same characters were also found, though to a lesser degree, in five other SES clones, 267, 278, 279, 351 and 367.

2339 SKINNER, J. C.
Selecting for resistance to lodging in sugar cane. Twenty-seventh conference, Cairns, Queensland, from 20th to 26th April, 1960.
Proc. Qd. Soc. Sug. Tech. 1960 : 37–46.

The force required to move individual stalks from the vertical through an angle of 16° or 20° was measured with a spring balance attached at a point one-third from the top of the millable cane. Significant differences were found between varieties growing in relatively poor hard soil and the measurements were positively related with resistance to lodging in the field. The term physical lodging resistance is proposed for the varietal characteristics estimated. Genetic constants indicated that selection for this character would be as effective as selection for yield in replicated trials. Physical lodging resistance was not associated with yield, sugar content, estimated commercial value, stalk number per stool, stalk length, stalk thickness or weight per stalk. Varietal disparities in physical lodging resistance were even more marked in canes growing on rich saturated soil. On such soil, highly resistant varieties could be distinguished by the subjective method of moving the stalks and stools by hand. Physical lodging resistance probably depends mainly on the type and size of the root system. The property is important not only in low-vigour varieties for rich land but also in vigorous varieties for poor land; the potential value of its measurement in breeding in Queensland is indicated.

2340 van der Zwet, T., Forbes, I. L. & Steib, R. J.
Studies on the *Phytophthora* rot of sugarcane seed pieces in Louisiana.
Plant Dis. Reptr. 1960 : **44** : 519–23.

A virulent isolate identified as *Ph. megasperma* was found on the recently released variety CP36–13. Tests on 24 varieties grown commercially in Louisiana showed a number of them to be fairly resistant, CP48–103 being the most resistant.

2341 Forbes, I. L. & Steib, R. J.
Spread of mosaic in leading sugarcane varieties under field conditions in 1959.
Sug. Bull. N. Orleans 1960 : **38** : 110–13.

The incidence of mosaic-infected plants in CP44–155 and CP48–103 indicates that these varieties can no longer be regarded as resistant but should be placed in the moderately resistant class.

2342 Abbott, E. V.
Studies of the mosaic problem in Louisiana.
Sug. Bull., N. Orleans 1960 : **39** : 23–27.

Recently mosaic has again become a problem in sugar-cane production in Louisiana, primarily because of the appearance of a new strain (H) capable of infecting commercial varieties hitherto considered resistant. CP36–13 and CP47–193 are the only commercial varieties which have remained relatively free from the disease under conditions of severe exposure to H. At the Houma station, most of the parent varieties tested, including several regarded as highly resistant or immune to mosaic, have proved to be susceptible to the new strain. The task of breeding for mosaic resistance will therefore be more difficult than in the past.

2343 Kramer, N. W.
Registration of sorghum varieties, IX.
Agron. J. 1960 : **52** : p. 666.

Recently registered in the USA, the sorgos Wiley [XXVII, 745], and Brawley [cf. XXIX, 538] and sweet Sudan grass Lahoma [XXIV, 3046] are described.

2344 Krmivovou základnu nám zlepší i cukrovka. Šlechtění a semenářství krmné cukrovky. **(Sugar beet also improves the forage stocks for us. The breeding and seed production of fodder sugar beet).**
Věstn. čsl. Akad. zeměd. Věd : 1959 : **6** : 245–50.

In this review of breeding fodder sugar beet in Czechoslovakia, aims and methods of breeding are discussed, reference being made to the use of heterosis. Fodder sugar beet is considered to be a very promising crop and should replace potatoes and mangels in some districts.

Relazione dell'ottavo anno di attività del Comitato Tecnico Permanente del A.N.B. **(Report of the eighth year of activity of the Permanent Technical Committee of the National Association of Beet Growers).**
Bologna 1960 : Pp. 209.

2345 *Gallarate, G. & Zocca, A. Indagini su varietà di barbabietole da zucchero svolte nel 1958. (Investigations on sugar-beet varieties carried out in 1958). (pp. 43–147).*

Further trials have been made with the original 15 commercial varieties [cf. XXIX, 2910], which were increased to 25 in some of the tests. The results, reported in full, show the polyploids to have been superior again in respect of both root and sugar yield. The highest sugar yields per hectare were again given by the three polyploids Hilleshög Standard, Kleinwanzleben Polybeta and Maribo P; Eagle Hill Polybrand was only slightly lower in yield and was later and less susceptible to *Cercospora*; Cesena Polyploid, though higher in sugar content and resistance to *Cercospora*, was inferior in yield of both roots and sugar.

The Italian diploid varieties mostly combined a relatively low root yield with a high sugar content; some of them, such as Alba, were equal or above the imported diploids in sugar yield but most were inferior.

None of the additional 10 varieties tested displayed any marked improvement over the original 15.

Among the newer lines, 64 of which were tested in preliminary trials, none exceeded the standard varieties significantly in yield of sugar per hectare.

The lines resistant to *Cercospora* again proved inferior to the others in sugar yield.

When sown in autumn in southern Italy, the lines with least tendency towards bolting were Cesena NSA, Klein AA and Rovigo AU, followed by US75 and Zwaanesse III; next in order came Polyrave, Pedigree SSA and Battle's E.

2346 Oldemeyer, D. L. & Rush, G. E.
Evaluation of combining ability in self-fertile lines of sugar beets using male-sterile testers.
J. Amer. Soc. Sug. Beet. Tech. 1960 : **11** : 175–85.

Seventeen self-fertile inbred lines and one open-pollinated variety were crossed with five cytoplasmically male-sterile tester lines. Together with the parents, the crosses were planted in a field test, data being recorded on sugar production per acre, sucrose percentage and root yield. Differences were found between the inbreds in general combining ability for all three determinations. Specific combining ability was particularly important in the case of root yield. Root yield tended to be negatively associated with sucrose content but this association was not strong. Heterosis and phenotypic dominance were found for both root yield and sucrose content. Parental performance showed little association with combining ability, the necessity of making test crosses to evaluate inbreds thus being indicated.

2347 BRYKCZYNSKI, J.
Efficient production of triploids in sugar beet.
Euphytica, Wageningen 1960 : **9** : 196–98.

Experiments at Rogow Opolski, Poland, indicate that for maximum production of triploids a parental mixture of about 20% diploids and 80% tetraploids should be used.

2348 DUYVENDAK, R.
The fraction of triploids in polyploid beet varieties.
Euphytica, Wageningen 1960 : **9** : 199–202.

The following factors affecting the proportion of triploids are briefly discussed: the proportions of diploids and tetraploids in the parental material; the parent from which the seed is harvested; male sterility; differential selection of *n* and 2*n* pollen; differential compatibility and viability; and arrangement of the plants.

2349 BØGH, H.
Chromosome-control in beet-root varieties.
Proc. int. Seed Test. Ass. 1960 : **25** : 288–97.

According to experience in Denmark, most polyploid varieties comprise 25–35% diploids, 45–55% triploids and 10–25% tetraploids, but these percentages may vary for the same variety. The composition of a polyploid variety depends chiefly on (1) difference in the survival of diploids and tetraploids when overwintered in the seed-producing field, (2) a varying relative number of flowers or seeds per plant in diploids and tetraploids and (3) a varying relative efficiency of the pollen from diploids and tetraploids. By means of formulae incorporating these sources of variability, the percentages of 2*x*, 3*x* and 4*x* plants may be calculated. Methods of seed sampling and chromosome counting are described.

2350 SNEGUR, G. P.
(Characteristics of seed production of sugar beet in Hungary).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 71–72. [Russian].

Mention is made of the colchicine-induced tetraploid varieties Polybeta 1 and Polybeta 3, which yield 3–8% more sugar per ha. and 18% more leaves than the best diploid varieties cultivated in Hungary. In seed yield the tetraploid forms equal the diploids but the weight of a seed cluster of the former is higher. The average number of viable shoots in the seed ball of a tetraploid is 1·2 as against 2·5 of a diploid and 1·4 of a triploid.

2351 DUDLEY, J. W. & POWERS, L.
Population genetic studies on sodium and potassium in sugar beets (*Beta vulgaris* L.).
J. Amer. Soc. Sug. Beet. Tech. 1960 : **11** : 97–127.

The genetics of sodium and potassium content was investigated in the commercial variety A54–1 and its broad-base derivative A54–1,BB, the inbred 50–406 and its broad-base derivative 50–406,BB, inbred 52–307, and the F_1 hybrid of 50–406 x 52–307, each grown with and without NP fertilizer. Low sodium content was dominant while low potassium content was dominant on fertilized plots and heterotic on nonfertilized plots. There was sufficient residual variance in the heterogeneous populations to permit of selection for sodium or potassium content. There was a significant negative association between means and the total within-population and treatment variance in respect of sodium content. Both sodium and potassium content followed a logarithmic scale except for 52–307 on unfertilized plots, which followed an arithmetic scale. It appeared that selection for low sodium content could be more readily effected on fertilized plots and for high sodium content on unfertilized plots. Selection for low or high potassium content could be done equally well on either soil type. Selection for high sodium + low potassium and *vice versa* would be difficult.

2352 BREWBAKER, H. E., OLDEMEYER, R. K. & BUSH, H. L.
Development of monogerm varieties of sugar beets by the backcross method.
J. Amer. Soc. Sug. Beet Tech. 1960 : **11** : 252–57.

After crossing GW304, a leaf-spot-resistant commercial variety, with the monogerm variety SL101, and back crossing five times, the monogerm character was successfully transferred to the GW line. No loss of yield or any other important character occurred. There was some evidence for a slight increase in sugar content, as compared with the recurrent GW parent. This is presumed to be due either to the acquisition of an additional gene for sugar content or to a pleiotropic effect on sugar content exerted by the monogerm gene itself.

2353 NOLL, A.
Untersuchungen zur Frage des Vorkommens von physiologischen Rassen bei *Cercospora beticola*. (**Investigations on the question of the occurrence of physiological races in *C. beticola***).
NachrBl. dtsch. PflSchDienst, Stuttgart 1960 : **12** : 102–04.

Amongst 90 samples of the pathogen from widely differing districts of western Germany, some differences in virulence on test varieties of sugar beet were observed, indicating the existence of physiological races of the fungus; the possibilities of identifying the races are discussed.

2354 NELSON, R. T., WOOD, R. R. & OLDEMEYER, R. K.
Selection of sugar beets for tolerance to endothal herbicide.
J. Amer. Soc. Sug. Beet. Tech. 1960 : **11** : 155–59.

At the Great Western Sugar Co., Longmont, Colo., two selections were made in the greenhouse for seedling tolerance of endothal, using a monogerm variety. Selection A was made on the basis of normal development of the primary root on seedlings growing in flats treated at a rate of 10 lb. of endothal per acre. Seedling survival with a rate of 140 lb. per acre was the criterion used for selection B. About 120 plants were selected for each group. Progeny tests in the greenhouse at these two rates of application showed that selection had resulted in improved tolerance, as judged by emergence and survival. A progeny test in the field with moderately high treatments (1½–4½ lb. per acre) revealed an increase in seedling vigour over the parent prior to thinning, but no differences between the selections and parent in prethinning stand and harvest results. Presumably the rates of application in the field trial were too low to give definitive data at harvest. Further selection has been made within selection B in an attempt to obtain still greater improvement in tolerance. The overall results with selection B have been sufficiently favourable to prompt commercial release of this variety and to explore the value of subjecting other varieties to selection for tolerance.

2355 PEREIRA, A. S., NERY, J. P. & CONAGIN, A.
Teor de ácido cianídrico na polpa das raízes dos aipins. (**The content of hydrocyanic acid in the core of cassava roots**).
Bragantia 1960 : **19** : 247–59.

Details are provided on the HCN content of seven edible and two wild varieties in tests at Campinas, São Paulo.

2356 DESHMUKH, M. J. & CHHIBBER, K. N.
Field resistance to blight (*Phytophthora colocasia* Rac.) in *Colocasia antiquorum*, Schott.
Curr. Sci. 1960 : **29** : 320–21.

The number of sporangia was four times higher in blight-infected plants of the susceptible *Colocasia* variety Patna Local than in the field-resistant variety Ahina. Other observations indicated that field resistance in *Colocasia* is essentially a weak type of hypersensitive reaction.

2357 NISHIZAWA, T.
(Studies on lotus rhizome rots).
Kyushu Nogyo Shikenjo Iho/Bull. Kyushu agric. Exp. Sta. 1960 : Pp. 75. [Japanese].

The principal rots were caused by *Fusarium* spp. and *Pythium afertile*. In a comparative test of nine varieties, Iyo and Kisarazu were least damaged by *Fusarium*; all varieties were equally susceptible to *P. afertile*.

STIMULANTS

2358 ANIŢIA, N.
Rezultatele principale obţinute în cercetările privind cultura tutunului în perioada 1928–1958. (**The principal results obtained from research on tobacco cultivation during the period 1928–58**).
Lucr. Inst. Cerc. aliment. 1959 : **4** : 11–27.

This review of Rumanian tobacco research during the above period briefly describes the breeding work that has been done and some of the principal varieties obtained.

2359 Ioan, E. & Ille, C.
Linii superioare de tutun Djebel selecţionate în R.P.R. (**Superior lines of Jebel tobacco selected in the Rumanian People's Republic).**
Lucr. Inst. Cerc. aliment. 1959 : **4** : 139–48.

Several improved lines have been selected from populations of the above variety imported from Bulgaria. The most promising is Jebel 264V.

2360 Sǎndulescu, R.
Obţinerea unui soi de tutun de mare producţie. (**The production of a tobacco variety with high yield).**
Lucr. Inst. Cerc. aliment. 1959 : **4** : 149–54.

A number of improved lines have been selected from the variety Ialomiţa; of these, the most productive are Ialomiţa 101 and 94.

2361 Sǎndulescu, R.
Obţinerea de forme gigante de tutun. (**The production of giant forms of tobacco).**
Lucr. Inst. Cerc. aliment. 1959 : **4** : 155–58.

A giant hybrid Gigant 412156 has been obtained from the cross Molovata x Maryland Mammoth. It grows 4 m. tall and bears 100–15 leaves; its content of nicotine is lower than in either parent and its content of soluble carbohydrates, especially on fermentation, is high.

2362 Henderson, R. G.
Performance of tobacco varieties and breeding lines tested in Virginia in 1958 and 1959.
Res. Rep. Va. agric. Exp. Sta. 1960 : No. 37 : Pp. 59. (Mimeographed).

Information is given on the yields, disease resistance and quality of named varieties and breeding lines of flue-cured, fire-cured and Burley tobacco.

2363 Jones, G. L. & Collins, W. K.
Measured crop performance. Tobacco, 1958 and 1959.
Res. Rep. NC agric. Exp. Sta. 1958 : No. 14 : Pp. 41; 1959 : No. 19 : Pp. 51.

Reports are given on trials of named varieties and advanced breeding lines with respect to agronomic characters and quality in several localities in North Carolina.

2364 Madamba, U. V. & Edrozo, L. B.
Variety test of White Burley tobacco at Luna, Mountain Province.
Philipp. J. Agric. 1956 : **21** : No. 1–4 : 123–33.

A report is given on the results of a trial of the White Burley varieties Haranova, Harrow Velvet, Ky16, Ky52, and Johnson Root-rot Resistant for four seasons at the Luna Tobacco Experiment Station, Mt. Province, Philippines.

2365 Burk, L. G. & Tso, T. C.
Genetic tumors of *Nicotiana* associated with chromosome loss.
J. Hered. 1960 : **51** : 184–87.

Studies on tumorous tissue of the hybrid *N. glauca* ($n = 12$) x *N. langsdorffii* ($n = 9$) indicated that chromosome loss may be the cause, rather than the result, of genetic plant tumours. Several tumour types were recognized by morphological differences and such characteristic chromosome numbers as 18, 19 and 38. No tumour cells with a chromosome complement of 21 or multiples thereof were found.

2366 Sand, S. A.
Relation between Sachs' grand period of growth and mutation at two loci in Nicotiana.
Genetics 1960 : **45** : p. 1009. (Abst.).

Use was made of clone S5230–5, of interspecific-hybrid origin, as in previous studies of the effects of temperature and chronic γ irradiation on mutation; this clone is heterozygous with respect to the mutable locus *V* and stable locus *R* affecting flower colour [cf. XXX, 1834]. Replicated cuttings were sand-cultured under conditions of controlled temperature and light. Somatic effects on the unstable and stable loci in the same tissue were compared by counting speckled sectors (changes from v_{S3} to v_s phenotype) and purple sectors (changes from *R* to *r* phenotype) in flowers from successive nodes of the main flowering axis, while germinal effects on the same two systems were analysed by counting speckled and purple individuals in progeny obtained by selfing flowers at selected node positions. Rates of somatic sectoring for both the mutable and stable genes were directly correlated with the natural change in rate of growth of the flowering branch, sector frequencies for middle nodes being about twice as high as those for proximal and distal nodes. Data on 1200 progeny in 14 families, distributed over 6 to 96% of the total nodal range, suggested a node-position effect of about 10% upon the frequency of speckled individuals, with the minimum number of such plants in families from pollinations of flowers from nodes in middle positions. These pollinations, however, gave the maximum frequencies of purple progeny.

2367 JAKOVUK, A. S.
(Problems of theory and practice in hybrid seed production of tobacco).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 8 : 27–33. [Russian].

The number of hybrids in the progenies from direct and reciprocal crosses of a series of varieties, without the emasculation of the ♀ parent, exceeded 80% for most sets of components at the Tobacco Institute. Particularly high percentages were obtained in crosses where the ♂ parent was biologically the more active. High percentages of hybrids resulted from pollination with self pollen + foreign pollen. In most cases a greater number of hybrids occurred when the ♀ parent was emasculated, but, for some sets of components, when the ♀ parent was left intact the number of hybrids was equally great or even greater. Differences were observed in the inheritance of characters by hybrids from ordinary crosses of two varieties and those from fertilization by self pollen + foreign pollen. For instance, normal hybrids of Dumar 2386 x Samsun 1857 had 35–36 leaves per plant but those from pollination with mixed pollen 50–52 leaves. The hybrids from pollinations of unemasculated flowers flowered later than hybrids from identical crosses where the ♀ parent had been emasculated.

2368 ANIȚIA, N. & IOAN, E.
Raionarea soiurilor de tutun în R.P.R. **(Regional standardization of tobacco varieties in the Rumanian People's Republic).**
Lucr. Inst. Cerc. aliment. 1959 : **4** : 107–28.

The origin and characteristics of the principal Rumanian varieties are described and the areas in Rumania to which they are adapted are indicated.

2369 IOAN, E.
Ameliorarea soiurilor orientale de tutun Drăgășani și Molovata. **(The improvement of the oriental tobacco varieties Drăgășani and Molovata).**
Lucr. Inst. Cerc. aliment. 1959 : **4** : 129–37.

The above varieties, respectively released in 1937 and 1929, now show considerable variation. Numerous lines have been selected from each, those especially recommended being Drăgășani 237 and Molovata 72.

2370 **Burley 37—A new black shank-resistant variety.**
Tenn. Fm. Home Sci. 1959 : No. 32 : p. 9.

[Cf. XXXI, 736].

2371 **Havana 501 tobacco.**
Crops & Soils 1960 : **13** : No. 1 : p. 20.

The cigar-binder variety Havana 501, the first of its type to have resistance to wild fire, mosaic and black root rot, has been released by the Wisconsin Agricultural Experiment Station in cooperation with the US Department of Agriculture.

2372 KELLER, K. R.
Registration of tobacco varieties.
Agron. J. 1960 : **52** : p. 666.

A description is given of the flue-cured tobacco Vesta 5, released in 1957 and recently registered in the USA. Developed at the Virginia Agricultural Experiment Station from Oxford 26 x Vesta 11, it produces leaves which cure easily to a rich lemon colour.

2373 GUTIERREZ, M. E.
Newly developed Virginia varieties Golden Special and Golden Boon.
Philipp. J. Agric. 1956 : **21** : No. 1–4 : 45–53.

Descriptions are given of Golden Special (Golden Harvest x Yellow Special) and Golden Boon (Golden Harvest x Bonanza), developed in the Philippines. In preliminary trials, the varieties have shown improvements over the parents in total yield and in production of bright lemon-yellow leaf.

2374 TERENT'EVA, A. I.
(A new tobacco variety, Trebizond 3072).
Tabak (Tobacco) 1960 : No. 4 : 46–48. [Russian].

Trebizond 3072 was obtained at the Tobacco Institute by crossing amphidiploid American 315 x *Nicotiana sylvestris* with American 315 and then crossing the resultant hybrids, which were grafted on tomato stocks, with Ostrolist 2747 [Narrow-Leaf 2747], also grafted on tomato. American 315 transferred its immunity from tobacco mosaic virus and *Erysiphe* to the new variety Trebizond 3072, which is highly productive of leaves, including top quality leaves, under irrigation. In recent trials in the Kuban' and in Kazahstan it outyielded Ostrolist 2747 and Trebizond 161 by a considerable margin.

2375 GUTIERREZ, M. E.
Identification of tobacco varieties within the type by flower coloration.
Philipp. J. Agric. 1956 : **21** : No. 1–4 : 31–44.

Eight varieties of White Burley and fourteen of Virginia are identified on the basis of the shade and pattern of flower coloration. Identification keys are included.

2376 Bullock, J. F., Chaplin, J. F. & Ford, Z. T.
S.C.58. A new black-shank-resistant tobacco.
Circ. SC agric. Exp. Sta. 1960 : No. 127 : Pp. 3.

Further information is provided on the flue-cured tobacco SC58 [XXIX, 4229].

2377 Kuhn, H. & Forejtnik, I.
Kritischer Beitrag zur Bestimmung des Nornikotins im Tabak. (**A critical contribution to the determination of nornicotine in tobacco**).
Fachl. Mitt. öst. Tabakregie 1960 : No. 1 : 1–17.

Different procedures are examined and compared and recommendations made for routine analysis.

2378 Burbidge, N. T.
The Australian species of *Nicotiana* L. (Solanaceae).
Aust. J. Bot. 1960 : **8** : 342–80.

The following new species and subspecies are described: *N. amplexicaulis* ($2n = 36$), *N. simulans* ($2n = 40$), *N. hesperis* ($2n = 42$), *N. cavicola* ($2n = 46$), *N. umbratica* ($2n = 46$), *N. occidentalis* ssp. *obliqua* ($2n = 42$) and *N. rotundifolia* ssp. *aridicola* ($2n = 44$). Detailed information is provided on the more important morphological features, the geographical distribution and the relationships of these and other Australian species.

2379 Stokes, G. W.
Difference in the behavior of the *Nicotiana longiflora* wildfire resistance locus in tobacco varieties Burley 21 and Ky 61.
Phytopathology 1960 : **50** : 770–72.

As expected, in crosses with susceptible parents, Burley 21 transmitted the resistance to *Pseudomonas tabaci* inherited from *N. longiflora* as though it depended on a single dominant factor [cf. XXX, 1344]. Progenies from crosses of Ky 61 with susceptible testers, however, contained more susceptible segregates than expected. In the case of the Ky 61 progenies, gamete selection through the pollen or an embryonic lethal factor could have influenced the segregation ratios. The data further suggested that the locus for resistance was situated on different chromosomes in the two varieties.

2380 Seigel, A.
Studies on the induction of tobacco mosaic virus mutants with nitrous acid.
Virology 1960 : **11** : 156–67.

Nitrous acid was found to be highly mutagenic for this virus; the symptoms in tobacco and the size of the lesion on *Nicotiana glutinosa* were the characters most frequently altered. There is some evidence that one mutagenic deamination occurs for each two or three lethal deaminations and every deamination produces a detectable effect.

2381 Palakarčeva, M.
(**A change in the resistance of tobacco to tobacco mosaic as the result of vegetative hybridization**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **8** : 89–102. [Bulgarian].

When the susceptible varieties Rila 9, Kozarsko 541, Harmanli Basma 163, Neurokop Basma and Džebelska basma [Jebel Basma] were grafted on to the resistant variety 888, no improvement in the resistance of the scions was observed in the year of grafting. In the first seed generation of the scions, however, 0·5 to 5·7% plants showed the local necrotic reaction characteristic of 888, and in the second generation derived from the necrotic plants, the percentage of resistant individuals varied from 29·24% to 52·48%, the proportion varying according to the initial scion variety.

When the scions were grafted a second time necrotic reactions were observed on the scions in the year of grafting, and the percentage of resistant plants in the first seed generation reached 80·83%.

2382 Marcelli, E.
A proposito di una variante necrotica del virus Y della patata. (**Concerning a necrotic variant of potato virus Y**).
Tabacco, Roma 1960 : **64** : 158–71.

A strain of potato virus Y causing necrosis in tobacco is described. The only plants resistant to it have proved to belong to *Nicotiana glauca* and *N. tomentosa*.

Annual Report of the Tea Research Institute of Ceylon for the year 1959 (1960) : Pp. 97.

2383 *Hutchinson, M. T. Report of the Nematologist for 1959. (pp. 59–66).*

After many years of testing and selection in pot and field tests, about 12 clones appear to be markedly resistant or tolerant with respect to *Pratylenchus coffeae*; the preliminary nature of this conclusion is however emphasized for several reasons. Problems encountered in classifying clonal reactions to this pest are discussed [cf. XXX, 4181]. One of the points is as follows. Comparison of first and second samplings of the nematode populations in pot tests indicated that progressive decline in the population was a more valid criterion of resistance in a clone than an initially low but increasing number.

2384 *Visser, T. Annual Report of the Plant Physiologist for 1959. (pp. 73–90).*

Preliminary observations on several clones suggested that cuticle thickness is not an important factor in resistance to blister blight (*Exobasidium vexans*).

The conclusion of Barua and Wight that the frequency of calcium oxalate crystals in the phloem of the leaf petiole (phloem index) is a genetical characteristic has been confirmed.

Thirty-five clones varying widely in leaf size and yield were all found to be diploid.

2385 KATAYAMA, Y. & NAGATOMO, T.
(Investigations of recently developed crops. V. Mountain tea).
Miyazaki Daigaku Nogakubu Kenkyu Jiho/Bull. Fac. Agric. Univ. Miyazaki 1960 : **5** : 157–71. [Japanese].

A biometrical study, in particular of the leaves, is reported of the wild tea (and seedlings raised from it) occurring on the mountains of Kyushu island, Japan. It is noted that the wild tea, unlike cultivated tea, usually has short-styled flowers. [Cf. XXVI, 3541].

2386 TOYAO, T.
(Studies on the utilization of polyploidy in the tea plant. II).
Chagyo Gijutsu Kenkyu/Stud. Tea 1960 : No. 22 : 6–17; Chagyo Kenkyu Hokoku/Tea Res. J. 1960 : No. 15 : 6–17. [Japanese].

Tetraploid plants are self sterile but gave rise to triploids when pollinated with pollen from $2x$ plants; the $2x$ (♀) x $4x$ (♂) cross is ineffective. Progeny with a wide range of chromosome numbers ($2n = 31–63$) were obtained by open pollination of $3x$ plants. In plant height and leaf size, the aneuploids are inferior to the euploids. [Cf. XXVIII, 4542].

2387 UENO, K., SUGIYAMA, H., SAITO, H. & FUKATSU, S.
(Studies on the process of manufacturing sencha tea from different varieties. II. On varietal differences on steaming).
Chagyo Gijutsu Kenkyu/Stud. Tea. 1960 : No. 22 : 41–52; Chagyo Kenkyu Hokoku/Tea Res. J. 1960 : No. 15 : 41–52. [Japanese].

Further to the first paper of this series [XXX, 2993], the authors report differences between the quality of the green tea (sencha grade) of four varieties according to the duration of steaming (10–40 sec.).

2388 HARADA, S., MASUDA, K. & ANMA [AMMA], S.
(Studies on the maturity of tea leaves. I. The relations between plucking time, growth and yield).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 91–109. [Japanese].

Data are provided on the leaf yield, number, length and weight of shoot and percentage of banjhi shoots at the first, second and third pluckings of four varieties.

2389 KUWABARA, Y. & SATO, T.
(Studies on the maturity of tea leaves. II. The relation between the proportion of banjhi shoots, various leaf characters and tea quality).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea. Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 110–29. [Japanese].

Using the same four varieties as in the preceding paper, a study was made of tea quality and style after each of three pluckings. It is noted that quality declines rapidly when the percentage of banjhi shoots exceeds 90%. Data are provided on the dimensions, colour and hardness of the leaves, percentage of banjhi shoots, and colour, aroma and flavour of the liquor.

2390 TORII, H. & OTA, I.
(Studies on the maturity of tea leaves. III. The relations between leaf maturity, tea quality and chemical composition).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea. Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 130–42. [Japanese].

Data are provided on the content of total nitrogen, soluble nitrogen and caffeine during the plucking cycle of the four varieties previously studied. The varieties differed in their values for these fractions but in all cases the contents declined with maturity. Positive correlations were found between the nitrogen fractions, especially total nitrogen, and style, and to a lesser extent leaf colour and aroma. No correlations appeared to exist with colour of liquor.

2391 HARADA, S., NAKAYAMA, A. & MITSUI, M.
(**Studies on the winter hardiness of tea. III. The effect of temperature and day length on the growth of tea varieties and the way in which this is affected by differences in winter hardiness**).
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1960 : **28** : 343–44. [Japanese].

As growing temperatures are raised, damage caused by a subsequent spell of —5° C. for 1 hr. also increases. A comparative study of 10 varieties showed that the hardiest varieties were damaged least by the higher growing temperatures. [Cf. XXX, 2994].

2392 HARADA, S., NAKAYAMA, A., KANO, T. & SAKAI, S.
(**Studies on the resistance of tea to cold. I. On the relation between enzyme activity and some other factors, on the one hand, and the resistance of tea varieties to cold, on the other**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 3–24. [Japanese].

A comparative study involving four varieties differing in degree of winter hardiness showed that resistance to cold is positively correlated with phosphorylase activity, total sugar content and chlorophyll content and negatively with amylase.

2393 HARADA, S., WATANABE, A. & KANO, T.
(**Studies on the resistance of tea to cold. II. Differences in the resistance of varieties to cold during the winter**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 25–38. [Japanese].

A series of 22 varieties were subjected to laboratory freezing tests. The varieties least injured were Yabukita and Yamatomidori [Japanese Green]. In general, green-tea varieties were hardier than black-tea varieties; the Assam-Chinese hybrids were all markedly susceptible to freezing. Positive correlations were observed between resistance to cold, on the one hand, and refractive index of the sap, dry-matter content and total sugars, on the other. Hardiness appeared not to be related to content of reducing sugars, transpiration rate or drought resistance.

2394 HARADA, S. & NAKAYAMA, A.
(**Studies on the resistance of tea to cold. III. On the relation between the growth and resistance to cold of tea varieties during the dehardening period**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 39–52. [Japanese].

Seven varieties were subjected to temperatures of 5, 10, 15, 20 and 25° C. during January-February or February-March. Differences were noted in the temperatures at which growth and dehardening occurred. The late and cold-resistant varieties Yamatomidori [Japanese Green] and Benihomare required a higher temperature for inception of growth than the other less cold-resistant varieties.

Some slight intervarietal differences in response to long photoperiods during the winter are also recorded.

2395 HARADA, S., WATANABE, A. & NAKAYAMA, A.
(**Studies on the resistance of tea to cold. IV. On the influence of the conditions of growth of tea, in particular autumnal training, on the resistance to cold of tea varieties**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 53–60. [Japanese].

Observations on the extent to which autumnal training of the bushes causes deterioration in the resistance to cold of a series of varieties are recorded.

2396 HARADA, S. & NAKAYAMA, A.
(**Studies on the resistance of tea to cold. V. On the relation between a temporary change in the water content of tea leaves and injury caused by cold**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 61–67. [Japanese].

Using seven varieties, observations are reported on the type of injury sustained by artificial freezing of shoots (1) with a normal water content or (2) deprived of water. It appeared that the damage caused by freezing differed for the two treatments, being caused mechanically by ice-crystal formation or by cell flooding after thawing in (1) and by desiccation of the protoplasm in (2).

2397 HARADA, S. & MITSUI, M.
(**Studies on the resistance of tea to cold. VI. On the relation between the water content of the soil and injury caused to tea by cold**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 68–75. [Japanese].

Ten varieties were studied. These were (1) given a normal supply of water or (2) deprived of water, and each treatment was followed up by (3) exposure in the field to cold wind or (4) shelter in a greenhouse. Treatment combination (2, 3) was most injurious, followed by (1, 3), suggesting that cold wind injures the plants by dehydration, the leaves being unable to draw water from frozen soil. The varieties differed markedly in their resistance to the effects of cold wind, those least injured being Yabukita and U4.

2398 HARADA, S., NAKAYAMA, A. & MITSUI, M.
(**Studies on the resistance of tea to cold. VII. On the phenomenon of leaf withering in tea resulting from a severe cold spell**).
Tokai Kinki Nogyo Shikenjo Kenkyu Hokoku : Chagyobu/Bull. Tea. Div. Tokai-Kinki agric. Exp. Sta. 1960 : No. 7 : 76–90. [Japanese].

A type of damage caused to Assam-Chinese hybrid clones and some black-tea clones by cold desiccating winds is described. The withering of the leaves is attributed to increased transpiration, freezing of the lamina or inhibition of water transport from the roots. [Cf. XXX, 2994].

2399 WIGHT, W. & BORA, P. C.
Botanical basis of red-spider resistance in tea.
Curr. Sci. 1960 : **29** : 395–96.

The phloem index for the frequency of calcium-oxalate crystals in the petiole [cf. XXVIII, 4543] was negatively and significantly associated with degree of infestation by *Oligonychus coffeae* in clones representative of var. *assamica* of *Camellia sinensis.*

2400 ANTUNES FILHO, H. & ALVES, S.
Melhoramento do cafeeiro. XIV. Competição de variedades comerciais em Monte Alegre do Sul. (**Improvement of coffee. XIV. Comparative trial of commercial varieties in Monte Alegre do Sul**).
Bragantia 1960 : **19** : 73–89.

Trials of 10 varieties during 1952–57 are reported. Mundo Novo outyielded all the other varieties but its coffee outturn was low. Data are also provided on the incidence of the various types of defective bean in each of the varieties.

2401 MÔNACO, L. C.
Melhoramento do cafeeiro. XVII. Seleção do café Maragogipe A.D. (**Improvement of coffee. XVII. Selection of the coffee Maragogipe AD**).
Bragantia 1960 : **19** : 459–92.

The above strain is higher yielding than ordinary Maragogipe. In 1935, 115 mother trees of Maragogipe AD were selected and numerous seedlings were raised following open pollination. Yield analyses of these over six years showed that selection for high yield was feasible from the first two crops. It was found that homozygous Maragogipe segregates (*MgMg*) yielded less than heterozygotes (*Mgmg*); in addition, *TT* segregates were inferior in yield to *tt* plants. Segregation for *Br*/*br* (bronze *v.* green buds) did not affect yield. Data are provided on the incidence of defective beans and coffee outturn of various progenies. Even the highest yielding progenies of Maragogipe AD failed to produce as well as other improved coffees bred at Campinas.

2402 ARRUDA, H. V. DE
Amostragem com sementes de café. (**Sampling coffee seeds**).
Bragantia 1960 : **19** : xxxi–xxxiii.

A machine is described which enables samples of beans weighing 150–200 g. to be taken which adequately represent the variation in bean type of whole progenies.

2403 MOH, C. C. & ORBEGOSO, G.
The induction of *angustifolia* mutants in coffee in R_1 generation by ionizing radiations.
Genetics 1960 : **45** : p. 1000. (Abst.).

When seeds of *Coffea arabica* were irradiated at the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, a high frequency of *angustifolia* mutants was obtained in the R_1. Degree of leaf elongation and narrowness varied with different mutants. The mutant character was usually a change involving the whole plant. No cases of reversion to normal have occurred. It has been reported that at least three recessive genes give rise, when homozygous, to the *angustifolia* condition, but induction of the R_1 mutants can hardly be explained on this basis. With thermal neutrons, the frequency of the mutants increased linearly with the dose. With X or γ rays, the frequency increased exponentially with dose.

2404 Achyuta Rao, Y. R. & Vishveshwara, S.
Studies in polyploids of *Coffea*. I. Polyploidy and stomata.
Indian Coff. 1960 : **24** : 303–06.

Examination of x–$8x$ material involving *C. arabica, C. congensis* and *C. canephora* at Balehonnur, India, showed that in general stoma number decreased with chromosome number but size of the aperture bore no relationship to degree of polyploidy.

2405 Moens, P. & Stessels, L.
Le greffage de plantules accélère les descendances dans l'amélioration du caféier Robusta. (**Grafting of seedlings accelerates the production of progeny in the breeding of Robusta coffee**).
Agricultura, Louvain 1960 : **8** : 595–608.

The period from sowing to flowering was shortened to 15 months by grafting the seedlings on to suckers. The fruits matured after a further 9·5 months and the seeds produced normal plants.

2406 **Coffee cultivation in India. Chapter V. Botany of coffee. Chapter VI. Breeding of coffee in India.**
Indian Coff. 1958 : **12** : 316–19, 370–72, 406–09; 1959 : **13** : 113–16, 165–68, 222–26.

The above chapters on the classification of species and cultivars and on breeding in India are included in a series of articles dealing with various aspects of coffee cultivation.

2407 **Eleventh Annual Report of the Research Department of the Coffee Board, Balehonnur P.O., S. India, 1957–1958** : Bull. No. 11 : Pp. 184.

Further interspecific and intraspecific crosses were made to combine high yield with resistance to leaf disease caused by *Hemileia vastatrix. Coffea arabica* 'S795' and selections from S178 showing resistance to *H. vastatrix* races I and II are being crossed with (*a*) selections from S12 Kaffa (from Ethiopia) which show good field resistance to the disease; (*b*) the varieties Padang and Philippinean which have vigorous growth and good bean characters; and (*c*) San Ramon, a variety with short internodes and a bushy growth habit. Seedling and clonal progenies of selections in the BA series continue to remain free from leaf disease. Evaluation of seedlings from the back-crossing programme was continued; eight promising single-plant selections show vigorous growth, high yield and freedom from leaf disease. Cytological studies were continued on interspecific hybrids and their back-crossed and selfed progenies; a haploid plant with $2n = 22$ was isolated from *C. arabica* 'Kent'. Of two *C. robusta* plants whose chromosome number was doubled by colchicine treatment, one shows contiguous sectors of diploid and tetraploid tissue. On flowering, the completely tetraploid plant produced large flowers with 6–7 stamens and corolla lobes, while the partial tetraploid produced smaller flowers with 5–6 stamens and corolla lobes.

Séptima Conferencia Interamericana de Cacao, Palmira, Colombia 13–19 de julio de 1958. (**Seventh Interamerican Conference on Cacao, Palmira, Colombia 13–19 July 1958**). Pp. 606.

2408 *Desrosiers, R. El problema de la* Ceratostomella *en el Ecuador. (The problem of* Ceratostomella *in Ecuador). (pp. 67–72).*
[Cf. XXVII, 3343].

2409 *Müntzing, A. Resistencia del cacao a enfermedades en pruebas de campo de la Hacienda Clementina, Ecuador. (Resistance of cacao to diseases in field trials at Hacienda Clementina, Ecuador). (pp. 183–86).*
[Cf. XXIX, 1848].

2410 *Bartley, B. G. D. Recent advances in genetics, selection, plant improvement and propagation. (pp. 521–23).*

Recent developments in cacao improvement are surveyed briefly, with particular reference to developments in the production of seed from interspecific crosses. Mention is made of studies in West Africa on the association between tree girth and performance and on the use of polyethylene in vegetative propagation.

2411 *Rubio, F., Desrosiers, R. & Bullard, E. T. Variaciones en rendimiento, valor de mazorca e incidencia de "escobas de bruja"* (Marasmius perniciosus, *Stahel) en progenies híbridas. [Variations in yield, pod number and incidence of witches' broom* (M. perniciosus *Stahel) in hybrid progenies]. (pp. 534–38).*

At the Tropical Experimental Station, Pichilingue, Ecuador, two clones resistant to witches' broom, SCA6 and SCA12, were crossed with four high-yielding clones, EET 6, 48, 238 and 248. Yield, disease incidence and pod number were all very variable in the progenies resulting from the various crosses. Average yields higher than in the parent clones were obtained from the progeny of only one cross, EET6 x SCA6. It is stated that a few hybrids have thus far developed no brooms.

2412 *Hernandez S., A. Importancia de la selección y propagación vegetativa en cacao. (The importance of selection and vegetative propagation in cacao). (p. 553).*

"The importance of selection and vegetative propagation of improved types of cacao in Venezuela is pointed out. 24 individual trees have been selected with yields between 6·1 and 2·3 kg. of dry cacao per tree."

[Author's summary].

2413 **Annual Report of the West African Cocoa Research Institute 1958–59.**
1960 : Pp. 87.

Studies on viruses have continued [cf. XXVIII, 3273]. A trial with clonal cuttings of 50 T17 parents has shown that there is correlation between the degree of tolerance to the New Juaben isolate of swollen-shoot virus and to the Kpeve isolate of the cacao mottle-leaf virus; certain lines proved to be quite tolerant of both viruses.

In a trial to determine resistance to black-pod disease, *Phytophthora palmivora*, the most resistant clones were ACU85 and S27. Morphological and pathological characteristics of six isolates of the pathogen are described.

Further details are given on the performance of domestic and introduced lines of cacao.

At the Ibadan substation, continued studies on Nigerian isolates of cacao viruses are in progress.

2414 **Annual Report, Inter-American Cacao Center, Turrialba, Costa Rica 1958.**
Cacao, Turrialba 1959 : **4** : No. 1 : Pp. 31.

A study of variations in susceptibility of selected cacao material to *Phytophthora palmivora* is under way. Data are presented on the performance of local cacao selections. Preliminary pollen studies have indicated that both temperature and humidity influence viability.

Three-month-old plants belonging to 11 UF clones were exposed to γ radiation. No morphological changes or abnormal growth signs were apparent two months after treatment. In another trial, in which 50 seeds of each of two clones were irradiated, it was found that substantial damage was caused by the treatment, particularly at dosage rates of 16,000 r. and above. The leaves in irradiated seedlings were abnormal and their growth was retarded compared with untreated controls.

The results of a number of clonal yield trials are presented and attention is drawn to the high-yielding lines UF 676, 221 and 613.

A study of Nicaraguan cacao types has indicated that the genes controlling pod type and bean colour are on different chromosomes. Correlations between the two factors, considered to exist in Criollo and Pentagona types, could, in fact, "have been the effect of a relatively high gene frequency for these characters in these populations, which was favoured by natural or artificial selection, or by geographic isolation". When the two types were grown together, they hybridized and resulted in the mixture of types characterizing Nicaraguan plantations of today.

A report on cacao research 1957–1958. The Regional Research Centre of the British Caribbean at the Imperial College of Tropical Agriculture, Trinidad, West Indies 1959 : Pp. 86.

2415 *Cope, F. W. Incompatibility in* Theobroma cacao. *(pp. 7–17).*

A ten-year study has revealed a type of incompatibility mechanism hitherto unknown in the plant kingdom. It does not involve the style but is delayed until male and female gametes have met in the embryo sac. Based on evidence obtained from a study of progenies derived from crosses involving ICS, SCA, Amazonian Forastero and Criollo clones [cf. XXIV, 3223 and XXVIII, 3274] the following is the suggested course of events:—

(1) Completely nonspecific precursor bodies are formed in diploid cells by the action of the *A* and *B* loci, and come to lie in the cytoplasm. (2) In pollen mother cells, the nonspecific precursor bodies are given some small modification by the dominant *S* allele to transform them into antigen precursors. The recessive allele also present is unable to produce its own antigen precursor because the dominant allele competes successfully with it for the nonspecific precursor. In megaspore mother cells, the dominant *S* allele acts upon the nonspecific precursor to induce the promotion of an antibody precursor, suppressing the recessive allele by competition. (3) After meiosis, the gametic nuclei carrying the dominant allele further endow the antigen and antibody precursors with full antigen and antibody properties which are specific for that

allele. Haploid nuclei carrying the recessive allele cannot further modify the antigen and antibody precursors because these have been "stamped" with the character of the dominant allele before meiosis. The specific antigen and antibody substances lie in the cytoplasm surrounding the male and female gametes; if both are present fusion does not occur. (4) Where alleles of equal dominance are together, both precursors are formed before meiosis. Both *S* alleles give a preliminary "stamping" to the nonspecific precursor, so that after meiosis the two types of haploid nuclei each have their own substrate with which to induce their own specific antigenic and antibody substances.

Some aspects of the significance of incompatibility are discussed. One beneficial aspect is the ease with which bulk seed of hybrid origin can be produced from self-incompatible parents.

2416 *Iton, E. F. Studies on a wilt disease of cacao at River Estate. (pp. 55–64).*

Several ICS clones, notably 1 and 95, have shown substantial resistance to this disease, caused by *Ceratostomella fimbriata*.

2417 CEVALLOS MURILLO, J. & CEDEÑO DUEÑAS, A.
Quinta de Propagación de Cacao, en Chone. (**Nursery for Cacao Propagation, at Chone**).
Rev. Consorc. Cent. agríc. Manabí 1960 : No. 96 : 5–10.

Information is provided on the performance at Chone of a number of clones obtained from other Ecuadorian experiment stations. A hybridization programme has now begun; it is hoped to develop high-yielding lines with resistance to witches' broom (*Marasmius perniciosus*).

2418 DELASSUS, M., BELIN, M. & BONAVENTURE, P.
Contribution à l'étude des pourritures des cabosses du cacaoyer en Basse Côte d'Ivoire durant les années 1958 et 1959. **(A contribution to the study of pod rots of cacao in the lower Ivory Coast during the years 1958 and 1959).**
Café, Cacao, Thé 1960 : **4** : 64–79.

A high degree of resistance to *Phytophthora palmivora*, the causal agent of black pod disease, has been found in the Samoan clone Lafi 5 and this has now been introduced into Africa. Certain variations in susceptibility to the disease have also been observed in Ghanaian cacao selections.

2419 TURNER, P. D.
Strains of *Phytophthora palmivora* (Butl.) Butl. from *Theobroma cacao* L. I. Isolates from West Africa.
Trans. Brit. mycol. Soc. 1960 : **43** : 665–72.

Study of 179 isolates from ten cacao-growing countries in West Africa revealed the occurrence of three types, differing in physiological and morphological characters, sexual behaviour and geographical distribution. The three categories are respectively referred to as G (Ghanaian), N (Nigerian) and A (Angolan). The predominant types G and N were sexually complementary; their simultaneous occurrence in some regions affords the opportunity for new strains varying in pathogenicity to arise through crossing.

2420 HARPER, J. L. & MCNAUGHTON, I. H.
The inheritance of dormancy in inter- and intraspecific hybrids of *Papaver*.
Heredity 1960 : **15** : 315–20.

Seed dormancy was very high in *P. rhoeas* (wild type), *P. dubium*, *P. lecoqii*, *P. argemone* and *P. apulum* but was considerably reduced in the cultivated Shirley variety of *P. rhoeas* as well as in a number of interspecific hybrids derived from the above species. Differences in the proportion of dormant seed from reciprocal hybrids indicated a predominantly maternal control in the determination of dormancy. Other data suggested a degree of direct embryonic control over dormancy; there appears to be an interaction between extra-embryonic and embryonic control systems.

2421 MENERET, C., SAINT-MICHEL, A. DE & COHN, E.
Houblons de la récolte 1959. (**Hops of the 1959 harvest**).
Brasserie 1960 : **15** : 257–69.

Extensive details are given on the performance of hop varieties in Alsace, Burgundy, Flanders and Lorraine in 1959.

2422 PAVLOV, K., ANDREEVA, E. & GEORGIEV, G.
(Investigations and experiments on hops in the Samokov and Sofia provinces).
Izv. central. naučnoizsled. Inst. Rasten. (News central sci.-res. Inst. Pl.-Industr.), Sofija 1960 : **9** : 17–54. [Bulgarian].

In the Sofia district, the most productive and highest in resins content of 24 varieties tested during 1949–58 were Savinski, hybrid V/69, Grone Bel and Cogneau, while in Samokov the best were the same first three and Tardif de Lorraine [Lorraine Late].

2423 **Trials of Wye variety hops: FF.21, OF.27, OZ.97a.**
J. Inst. Brew. 1960 : **66** : 383–97.

Commercial brewing trials have shown FF21 (Early Choice) and OF27 to be acceptable replacements for 25% of a normal hop grist. OZ97a was not favoured, even at 25% replacement.

MINOR CROP PLANTS

2424 DIMITROVA, E. M.
(The nature of inheritance in the reproduction of *Lavandula vera* L. from seed. I. The utilization in breeding and seed production of the seed progeny obtained by open cross pollination).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **8** : 143–59. [Bulgarian].

In isolated groups of plants selected for morphological uniformity and good economic properties and allowed to interpollinate only with members of the same group, the good characters of each group were maintained in successive generations. In selected material open-pollinated by unknown male parents, the progeny generally resembled the female parent in morphological characters, the percentage of deviating individuals, which reaches 17%, increasing with increasing differences between the female parent and the surrounding male parents. In content of essential oil and linalool acetate, the progeny was more variable but was on the whole similar to the female parent.

2425 MAHOUT, G.
La sélection de la lavande. **(The selection of lavender).**
Bull. tech. Ing. Serv. agric. 1960 : No. 153 : 575–81.

Methods and criteria for the improvement of lavender are discussed, with particular reference to work now being conducted by the Agricultural Services Division in the Hautes-Alpes department and by the Agricultural Research Station at Antibes. A total of 1600 clones are currently under observation.

2426 KOZŁOWSKA, M. & KROPP, K.
Badania odmianowe papryki w warunkach polski potudniowej. **(Studies of red pepper varieties under the conditions of southern Poland).**
Zeszyt. nauk. wyższ. Szkoł. roln. Krakow: Rolnictwo 1959 : **6** : No. 9 : 177–91.

Data are given on yield, size, shape of fruit and ascorbic-acid content of 17 varieties tested during 1954–56.

2427 DASKALOV, H. & POPOVA, D.
(New early hybrid varieties of red pepper).
Izv. central. naučnoizsled. Inst. Rasten. (News central sci.-res. Inst. Pl.-Industr.), Sofija 1960 : **9** : 185–95. [Bulgarian].

Cecei csüngő D–103 [Cece Pendulous D–103], which is early and good in combining ability, has yielded the following hybrids: D–103 x Sivrija 600, D–103 x Kalinkov 805 and D–103 x Bjala Kapija [White Gate]. All three are early, productive, good in quality and suited to cultivation in the open or the greenhouse under Bulgarian conditions.

2428 GEORGIEVA, R.
(The mode of variability in experimentally produced autotetraploid peppers).
Nauč. Trud. visš. selskostopan. Inst. G. Dimitrov. (Sci. Trans. G. Dimitrov high. agric. Inst.) 1959 : **7** : 173–94. [Bulgarian].

Autotetraploids of *Capsicum* are characterized by the increased size of the cell, leaf, stem, flower, stomata, pollen and seed. The viscosity of the cytoplasm, the size of the fruits and the number of seed are reduced. Growth is rapid but the plants mature slowly, flowering and fruiting occurring much later than in normal plants. The autotetraploids are consequently not adapted to the climate of the Sofia valley where frosts commence at the end of September. The autotetraploids are unstable and productivity decreases in subsequent generations. At present amphidiploids appear to be more important than autotetraploids for breeding.

2429 POPOVA, D.
(The duration of pollen viability and stigma receptivity in red pepper).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **8** : 215–27. [Bulgarian].

At 20–22° C. and 50–55% humidity, pollen viability is retained for 8–10 days; seed and fruit set are reduced after 5–6 days' storage. Stigma receptivity lasts 5–7 days, and decreases after the fifth day after emasculation, resulting in fewer seeds/fruit. The highest fruit set is obtained when pollen from a newly dehisced anther or a one-day-old flower is used to pollinate a flower in its third developmental phase.

2430 Sowell, G. (Jun.)
Bacterial spot resistance of introduced peppers.
Plant Dis. Reptr. 1960 : **44** : 587–90.

Of 659 introduced lines and varieties tested at the Regional Plant Introduction Station, Experiment, Ga., for resistance to *Xanthomonas vesicatoria*, PI numbers 163184, 163189, 163192, 164471, 164677, 173877, 182646, 182925, 183439, 183440, 183441, 183922, 244669, 244670 and 246331 of *Capsicum frutescens* are considered sufficiently resistant to be of use to breeders. Most of the resistant lines have small, pungent fruits but individual plants of PI182925 have been observed to produce large, sweet fruits.

2431 Dickinson, D.
A new way of sorting sweet peppers from hot ones.
Ill. Res. 1960 : **2** : No. **4** : 18–19.

One of the problems in breeding peppers for resistance to *Verticillium* wilt is that the progeny of crosses involving resistant wild peppers includes a number of "hot-fruited" plants containing capsaicin. A new chromatographic technique, which has been devised for the rapid detection of these plants, is described.

2432 Cook, A. A.
Virus disease resistance in peppers.
Proc. Fla. hort. Soc. 1959 : **72** : 110–12.

Referring to published papers, the author outlines work on the genetics of resistance to tobacco mosaic, tobacco etch and potato virus Y in *Capsicum annuum* and on breeding for resistance to these viruses at the Florida Agricultural Experiment Station.

2433 Pound, G. S. & Singh, G. P.
The effect of air temperature on multiplication of tobacco mosaic virus in susceptible and resistant pepper.
Phytopathology 1960 : **50** : 803–07.

It was reported by Crossan and Rahn [cf. XXVIII, 3283] that Yolo Wonder was free of tobacco mosaic virus symptoms one month after inoculation under field conditions. The present study indicates that this would not be the case at 24° C. or above unless the strain used contained the local-lesion gene *L*; no stock tested at Madison, Wis., possessed this gene. At 16 and 20° C., inoculated plants developed very mild symptoms and virus concentration was low. Disease severity and virus concentration increased with increase in temperature and no evidence of a cyclic concentration pattern was found. Resistant segregates of *Capsicum frutescens* '163201,' which was found to be heterozygous for the local-lesion gene, were immune to systemic invasion by the virus, and resistance was expressed independently of air temperature. In the susceptible variety California Wonder and in susceptible segregates of 163201 a cyclic pattern of virus concentration was observed.

2434 **Eleventh Annual Report of the Indian Central Oilseeds Committee 1957–58** : Pp. 181–xxvii.

Breeding and varietal testing of groundnut, linseed, castor oil plant, sesame and *Brassica* spp. were carried out.

Brassica. The self incompatibility found in certain varieties of brown sarson is thought to be of the sporophytic type. Studies with male-sterile plants indicate that this character is monogenically controlled. Treatment of toria, rai and brown and yellow sarson varieties with X rays, S^{35} and P^{32} has resulted in the production of some higher-yielding and earlier-flowering lines in all four crops. A comparison of diploid and autotetraploid plants of toria T–22 under different cultural conditions showed the $2n$ plants to be the higher yielders.

Sesame. White-flowered and small-seeded mutants obtained from X-irradiated *S. orientale* type 16 have maintained their higher oil contents. The white-flowered mutants flower 3 days earlier and the small-seeded mutants 1 day earlier than the controls. Treatment of types 12, 16 and 20 with X rays, S^{35} and P^{32} has led to the development of some lines with greater numbers of fruits and with higher seed weight than the parents.

Linseed. Testing for wilt and rust resistance continued.

Groundnut. Breeding for disease and drought resistance is in progress and an attempt is being made to develop a strain of Pollachi Red with a dormant period. From cytological studies on the diploid ($2n = 20$) species *Arachis prostrata*, *A. duranensis* and *A. villosa* it is suggested that these may be allotetraploids with 5 as the basic number. Chromosome associations in two triploid hybrids obtained by crossing a tetraploid cultivated variety with an unspecified diploid wild species indicated that one genome of the triploid was homologous with that of the diploid parent; it is concluded that the tetraploid probably developed by chromosome doubling of a hybrid between two related species. Two short chromosomes were found in the chromosome complements of both the diploid and tetraploid species; the possibility that the latter may be octoploid is suggested.

2435 ANDERSSON, G.
Fettet i växtförädlingsarbetet med oljeväxter. **(Oil in oil-crop breeding work).**
Sverig. Utsädesfören Tidskr. 1960 : **70** : 235–60.

Climate, nitrogen dressing, sowing time and harvesting time are shown to have varying effects upon the oil content of rape, mustard and linseed, but genetical variation is sufficient to permit breeding. A rapid method for the determination of the oil content of small samples of seed has been devised. In white mustard, positive and negative selection over six years has changed the oil content from an initial 28·3% to respectively 31·5% and 25·1%. Similarly, the rubber content of kok saghyz has been increased from about 4% to 15·5% by six years' selection. Work on improving oil composition has been initiated in Sweden and the remainder of the paper reviews foreign work on this aspect of breeding.

2436 BIJOK, K.
Studie nad kariologią *Brassica napus* L. var. *biennis* (Schübler et Mart.) Rchb. i *Brassica napus* L. var. *typica* Posp. [Study of the caryology of ***B. napus*** **L. var.** ***biennis*** **(Schübler et Mart.) Rchb. and** ***B. napus*** **L. var.** ***typica*** **Posp.**].
Acta Soc. Bot. Polon. 1959 : **28** : 365–72.

Eight Polish forms of *B. napus* var. *biennis* and two of *B. napus* var. *typica* all had $2n = 38$. Caryotypic data are presented for each of the botanical varieties.

2437 SCHULZ, K.
Über Untersuchungen zur Feststellung der Winterfestigkeit von Rapsstämmen. **(Investigations on the determination of the winter hardiness of rape strains).**
Z. Acker- u. PflBau. 1960 : **111** : 203–13.

Two strains were tested and it was found that more winter killing occurred in cold frames than in the open, the temperature being lower in the frames. It is thought that the results of frame experiments are unreliable and they can only be used in combination with other observations. In drill experiments, overwintering depended on the density of the stand.

2438 GURSHAM SINGH, KHEM SINGH GILL & RANA, N. D.
Effects of selfing and sibbing on certain characters in *Sesamum*.
Indian Oilseeds J. 1960 : **4** : No. 4 : 271–75.

Studies on the effects of self, sib and open-pollination on five quantitative characters in five varieties of *S. orientale* were carried out at the Oilseeds Breeding Substation, Mangival, Punjab. The results showed that selfing had no adverse effects on the vigour of the varieties. Sib pollination, as compared with the other two methods of pollination, led to an increase in all the characters except plant height; the increase was significant in the case of two characters, number of branches and yield per plant.

2439 KEDHARNATH, S., RAMANUJAM, S. & JOSHI, A. B.
Chromosome pairing in two sesquiploid hybrids and its bearing on genome relationship in the genus *Sesamum*.
Indian J. Genet. 1959 : **19** : 201–09.

The amphiploid ($2n = 58$) synthesized from *S. indicum* ($2n = 26$) x *S. prostratum* ($2n = 32$) was back crossed as ♀ with both parental species. Very few viable seeds were secured, although sufficient numbers of pollen tubes to fertilize all the ovules reached the ovaries. Meiosis was studied in the two types of sesquidiploids thus produced: (1) $2n = 42$ plants with two sets of *S. indicum* and one of *S. prostratum* chromosomes, and (2) $2n = 45$, with two sets of *S. prostratum* and one of *S. indicum*. At metaphase I in (1), the PMCs contained, in addition to univalents, 13_{II} or, less frequently, bivalents and trivalents. In (2), 16_{II}, or bivalents and trivalents, were observed, as well as univalents. In both (1) and (2), the maximum number of trivalents was three. Some intergenomic pairing therefore occurred. In (1), the *S. prostratum* univalents tended to be eliminated from the ♂ gametes, but in (2), the *S. indicum* univalents tended to be included. Type (1) had about 50% male or female fertility. Many of the progeny obtained by selfing or back crossing to *S. indicum* had $2n = 26$ and resembled the latter species, although a few showed some characters of *S. prostratum*. Aneuploids with 1–3 extra *S. prostratum* chromosomes were also recovered with a low frequency. Type (2) was completely pollen sterile, but set a few seeds when pollinated by *S. indicum* or *S. prostratum*. The chromosome number and morphology of the hybrids thus secured suggested that only ♀ gametes with 16 *S. prostratum* chromosomes had functioned. Five hybrids from type (2) x *S. indicum* had $2n = 29$ and resembled the original F_1 *S. indicum* x *S. prostratum*; six hybrids from type (2) x *S. prostratum* had $2n = 32$ and closely resembled *S. prostratum.*

2440 Langham, D. G.
Breeding sesame(*Sesamum indicum* L.) varieties to meet specific demands of commercial utilization.
Genetics 1960 : **45** : p. 997. (Abst.).

Examination of seed pods of numerous varieties in Venezuela has revealed the occurrence of sufficient genetic variability to make it possible to develop lines with various degrees of shattering corresponding to various different commercial requirements. By breeding, it is possible to secure different combinations of stiff rachis, thin seed-pod opening only at the tips, "seed in blocks" and other characters, in order to attain the desired degrees of shattering. The pharmaceutical industry demands sesame oil with an extremely low free fatty acid content, which must therefore be extracted from seed free from threshing scars. A shattering pod permitting threshing simply by inverting the bundle is thus required. At the other extreme, large-scale farmers demand an indehiscent variety for mechanized methods. Still other industries, such as perfume and confectionery manufacture, require different types again.

2441 Mazzani, B.
Variaciones del contenido en aceite de la semilla en cultivares locales de ajonjolí (*Sesamum indicum* L.). [**Variations in the seed oil content of local cultivars of sesame (*S. indicum* L.)**].
Agron. trop., Venezuela 1959 : **9** : 3–10.

Results of a 3-year trial in Venezuela showed that the seed oil content of seven sesame cultivars was more influenced by environmental effects than by inherent differences between cultivars.

2442 **Basic research and flax improvement.**
Agric. Res., Wash. 1960 : **9** : No. 5 : 6–7.

Work on linseed genetics and breeding at the Minnesota Agricultural Experiment Station is outlined. Problems encountered in the attempt to introduce the high oil content and high iodine number of yellow-seeded linseed into brown-seeded varieties are discussed. The association of desirable characters with yellow seeds and the quantitative mode of inheritance of oil content and other properties are among the problems.

2443 Kedharnath, S., Joshi, A. B. & Batcha, M. G. B. R.
Correlation studies in *Linum usitatissimum* - II. Effect of morphological grouping of types on the correlation coefficients relating to yield and some of the components of yield.
Indian J. Genet. 1960 : **20** : 58–68.

Ten plants each of 100 linseed varieties comprising brown large, brown small, yellow large and yellow small-seeded types, were assessed for yield, 1000-seed weight, number of capsules per plant, number of seeds per capsule and ripening period (days from first flowering to first capsule maturity). Correlation values between the various characters were obtained (1) for the whole collection of varieties and (2) for each of the four groups. The values obtained for the collection as a whole were found to mask widely differing behaviour in the four groups; it is concluded that the correlations found in this collection will not necessarily exist in a different collection.

2444 Joshi, A. B., Kedharnath, S. & Batcha, M. G. B. R.
Correlation studies in *Linum usitatissimum* - III. Effect of morphological grouping of types on the correlation coefficients relating to oil content and oil quality.
Indian J. Genet. 1960 : **20** : 69–78.

A highly significant positive correlation was found between oil content and seed size when 100 linseed varieties were considered as a single group. When the varieties were classified into four groups on the basis of seed size and colour, correlation was found to be significant in the brown-seeded groups and nonsignificant in the yellow-seeded groups.

Correlation between oil content and length of the ripening period was high in the varieties as a whole and in the four groups. Together the varieties showed a significant correlation between oil content and iodine value, but this was mainly due to the brown large-seeded group, correlations in the others being non-significant. The varieties showed little correlation between oil content and refractive index, but on a group basis the brown-seeded types showed a positive correlation while the yellow-seeded types showed a negative correlation

which was low in the large-seeded but highly significant in the small-seeded types.
Correlation between iodine value and refractive index was high and was not appreciably altered when assessed on a group basis. While a good correlation was found between iodine value and ripening period in the varieties as a whole, this was significant only in the large-seeded groups. Refractive index and ripening period were highly correlated in all except the yellow large-seeded group. While a positive but nonsignificant correlation was found between refractive index and seed size in the varieties as a whole, a highly significant negative correlation was found in the brown large-seeded group while the yellow small-seeded group showed a significant positive association; correlations in the other two groups were nonsignificant. A high positive association was found between seed size and ripening period both for the varieties as a whole and for the two brown-seeded groups. In the yellow-seeded groups however correlation was significant only in the small-seeded types.

2445 KHEM SINGH GILL & GURSHAM SINGH
Study of exotic linseed varieties in search of new germ-plasm.
Indian Oilseeds J. 1960 : **4** : No. 4 : 258–66.

A total of 69 introduced varieties were compared with K2 at the Oilseed Breeding Substation, Nagrota Bagwan, Punjab. Most of the introduced varieties were resistant to rust (*Melampsora lini*) and *Fusarium* wilt, while seven were immune to both diseases. One of these seven, LI5665, was also totally immune to powdery mildew (*Erysiphe* sp.). The tillering and capsule-bearing capacity of many of the introductions were significantly better than in K2. The oil content in all the introduced varieties was lower than in K2, but in five lines the iodine number was higher. The possibilities of utilizing the genetic variability revealed in this study are discussed.

2446 VRÎNCEANU, V.
Producerea seminţei elită si reînnoirea anuală a soiurilor de floarea-soarelui. **(The production of élite seed and annual renewal of sunflower varieties).**
Probl. Agric., Bucureşti 1960 : **12** : No. 7 : 41–46.

Improvements of the seed yield and oil content of Soviet varieties introduced into Rumania have been obtained by selection during seed production.

2447 HEISER, C. B. (JUN.) & SMITH, D. M.
The origin of *Helianthus multiflorus*.
Amer. J. Bot. 1960 : **47** : 860–65.

From morphological and cytological evidence and the results of artificial interspecific hybridization, it is concluded that *H. multiflorus* ($2n = 51$) probably originated in Europe through spontaneous crossing between *H. decapetalus* ($n = 34$) and *H. annuus* ($n = 17$), after introduction of these species from North America.

2448 DUBSKÝ, V.
Kříženec slunečnice s topinamburem—nadějná krmná plodina. **(A cross between sunflower and Jerusalem artichoke—a promising fodder crop).**
Za socialist. Zeměd. 1959 : **8** : 352–58.

Information is provided on three hybrids differing in their time of flowering. They produce considerably more green fodder than the parental species.

2449 PRIADCENCU, A. *ET AL.*
Comportarea plantelor consangvinizate de floarea-soarelui din soiul Jdanov 8281. **(The behaviour of inbred plants of sunflower of the variety Ždanov 8281).**
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 159–70.

The effects of inbreeding five Soviet varieties are recorded. Variability increased and yield and quality fell. Productivity exceeding that of Ždanov 8281 resulted from crossing this variety with one or a mixture of inbred lines.

2450 NICOLAU, A.
Cîteva observaţii privind aplicarea consangvinizării la floarea-soarelui. **(Some observations on inbreeding the sunflower).**
Stud. Cercet. şti : Biol. Şti. agric. Iaşi 1960 : **11** : 133–37.

Data are provided on the decline in seed number and changes in the chemical composition of the seed resulting from two generations of inbreeding. Three varieties were studied. Information is also given on the effect of pollinating the inbreds with the parental variety and of open pollination.

2451 ŽDANOV, L. A.
(General biological theory and the breeding of oil plants).
Agrobiologija (Agrobiology) 1959 : No. 5 : p. 767. [Russian].

Mičurinism, which has evolved from Darwinism and Lamarckism but without their "errors", is regarded as the basis of general biological theory.

The familiar Mičurinist method used in breeding sunflowers is mentioned briefly.

2452 KELLNER, E., POPESCU, G. & SLUŞANSCHI, H.
Experienţe cu floarea-soarelui cultivată pentru nutreţ murat. (**Experiments with sunflower cultivated for fodder**).
An. Inst. Cerc. agron. Romîn. : Ser. B 1958 : **26** : 267–75.

Data are included on the green-matter content and chemical composition of five varieties. The highest yield of green matter per ha. was given by Vărgată de Cluj [Cluj Striped].

2453 LONG, R. W.
Biosystematics of two perennial species of *Helianthus* (Compositae). I. Crossing relationships and transplant studies.
Amer. J. Bot. 1960 : **47** : 729–35.

The results of hybridization experiments indicated that *H. giganteus* and *H. grosseserratus* are closely related genetically, isolation of the two species being due to differences in ecological adaptation and significant but incomplete differences in time of flowering. It is suggested that the two taxa should be termed ecotypes and that they belong to a large diploid ecospecies, to which *H. maximiliani* and *nuttallii* may also be assigned.

2454 ŠTĂRBANOVA, E.
(**Studies on the enzymes invertase and peroxidase in sunflower seedlings and adult plants in connexion with their resistance to broomrape**).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 151–62. [Bulgarian].

In plants grown in soil free from *Orobanche cumana*, invertase shows mainly hydrolytic activity during bud formation and synthetic activity during flowering and flower shedding. When grown in soil containing *O. cumana*, resistant plants showed the same changes in invertase activity, but in susceptible plants the hydrolysing activity was predominant throughout. Treatment of seeds with 0·2–0·4% solutions of ascorbic acid before sowing increased the synthetic activity of invertase in the plants grown from them.

2455 **Seventh Annual Report of the West African Institute for Oil Palm Research, 1958–1959** : Pp. 140.

The main breeding programmes, as described in last year's report [of. XXX, 682], have been continued. The yield and fruit composition are given for palms selected for breeding in the Deli and Angola programmes.

It has been decided to limit seed production to *dura* x *pisifera* crosses and thus the work devoted to the *pisifera* palm has increased during the past year, particular attention being paid to progeny testing; factors being examined include leaf production, inflorescence production, sex of inflorescence, degree of fertility, development of the fruit before rotting and characteristics of the ripe fruit.

2456 FERRAND, M.
Le noli (*Elaeis melanococca* ou *Corozo oleifera*) en Colombie. [***E. melanococca*** (= ***C. oleifera***) **in Colombia**].
Oléagineux 1960 : **15** : 823–27.

Three varieties, similar to the *nigrescens*, *albescens* and *viridis* varieties of *E. guineensis*, are found in Colombia. Populations of this oil palm in Colombia have insufficient variability to give promise of any large increase in oil-yielding ability as a result of selection.

2457 PATNAIK, S., PATRA, B. C. & MOHAPATRA, K. C.
Flowering behaviour and anthesis of *Curcuma longa* L.
Curr. Sci. 1960 : **29** : p. 402.

Observations made at the Turmeric Research Station, Orissa, are recorded. Anther dehiscence took place just at the time of flower opening and pollination was effected by insects, the structure and position of the spur of the single fertile anther among the three anthers per flower being such that this mode of pollination was favoured.

2458 Léčivé rostliny. (**Medical plants**).
Za socialist. Zeměd. 1958 : **8** : 1023–26.

Heřmánek pravy-velkokvětý [Camomile with Truly Large Flowers] is a new variety produced by colchicine treatment of a local type; it has a high drug content.

2459 DE SILVA, C. A.
The performance of "exchange" clones imported into Ceylon.
Quart. J. Rubb. Res. Inst. Ceylon 1960 : **36** : 1–16.

Details are given on the performance in Ceylon of 80 clones imported from Indonesia, Malaya and Viêt-nam.

2460 **Annual Report of the Rubber Research Institute of Malaya for 1958** : Pp. 123.

Progenies were obtained from further crosses between clones imported as resistant to *Dothidella ulei* and high-yielding eastern clones. Seedlings from the 1947 programme of hand pollination have been tapped for three years, but no family is outstanding. The best is RRIM507 (Pil B84 x Pil A44) x Tjir 1 which has given a mean yield of 35 g. per tree per tapping, as against 25 g. for Tjir 1 illegitimate seedlings. Families from the 1948 hand pollinations which have given the highest yields over two years of tapping are 44/553 (Tjir 1 x Pil B84) x RRIM501 (Pil A44 x Lun N), RRIM623 (PB49 x Pil B84) x RRIM501 (Pil A44 x Lun N) and 33/520 (Tjir 1 x PB24) x RRIM501 (Pil A44 x Lun N). The tenth year of tapping of most of the large-scale trials of the RRIM500 series of clones has been completed. RRIM 501, 513 and 519 retain their leading positions. RRIM501 gives the greatest early gain but the other two clones, especially RRIM513, appear to have sustained their yields better over the whole period owing to resistance to wind damage and better secondary characters. Trials of clones RRIM 600–618 and 619–630 at the experiment station of the institute are in the third and second year of tapping respectively. By using a method of squashing root tips and staining with basic fuchsin, chromosome counts have been made in RRIM501 illegitimate seedlings and in clonal roots arising from buddings of PR107. The normal diploid number (36) was found.

2461 MENDES, L. O. T.
Observações sôbre a produtividade de seringueiras (*Hevea brasiliensis* Muell.-Arg.) plantadas de sementes. II. Produtividade de 100 plantas do seringal Mirim, em Manaus. III. Estudo da produtividade de 507 plantas localizadas no Hôrto Florestal de Manaus. IV. Produtividade de 29 plantas existentes na Travessa Itororó, Belém, Pá. **[Observations on the productivity of rubber seedlings (*H. brasiliensis* Muell.-Arg.) planted from seed. II. Productivity of 100 plants in the Mirim rubber plantation in Manaus. III. Study of the productivity of 507 plants located in the forest nursery, Manaus. IV. Productivity of 29 plants existing in the Travessa Itororó, Belém, Pará].**
Bragantia 1960 : **19** : 393–417, 419–33, 689–709.

Further data are presented on the latex yields of seedling plantations; it appears that unselected seedlings sown at high densities can be used as commercial planting material. The low yielders, though forming the majority of seedlings, can be eliminated when thinning [cf. 815].

2462 **Annual Reports of the Rubber Research Institute of Ceylon for 1958 (1959)** : Pp. 129; **1959** (1960) : Pp. 130.

Further test tapping was carried out on (1) clones derived from hand-pollinated seedlings, (2) clonal seedlings and (3) foreign clones and local clones established from imported clonal seedlings. Over 80% of the RRIC clones test-tapped, consisting of trees ranging in age from 12 to 18 years, are yielding over 20 lb. dry rubber per tree per year. Breeding for the next few years will perforce be limited to *Oidium* resistance and general improvement. A permanant *Oidium*-testing station has been established on the Kepitigalla estate. *Dothidella*-resistant IAN clones of the BC_2 or outcross with the eastern parent (PB86 or Tjir 1) were obtained in exchange with Brazil. The parentage of these clones is seven-eighths of eastern parentage and one-eighth of the *Hevea benthamiana* clone F4542 which is resistant to *Dothidella ulei* and tolerant of *Phytophthora palmivora*. Altogether, ninety *Dothidella*-resistant introductions are now available for testing reaction to *Oidium* and *Phytophthora* and for use in subsequent breeding for disease resistance combined with high yield. Pollination procedures have been revised to provide pathological control. A breeding station is to be established in the *Phytophthora*-free Moneragala district where the main flowering season occurs in May-June instead of February-March, as is normally the case in western Ceylon. Two breeding programmes may thus be realized each year. Promising results have been obtained in experiments designed to promote early flowering in young budded plants by ringing and other methods, and thus to accelerate breeding.

2463 MOISEEVA, V. P.
(The yielding ability of annual and biennial forms of kok-saghyz).
Bot. Ž. (Bot. J.), Moskva 1960 : **45** : 1175–78.

Figures are given showing that the proportion of plants with large roots is higher in biennial than in annual forms and the prospects for selecting forms with high yield are consequently better.

2464 MENDES, L. O. T.
Selecão e melhoramento do timbó. II. Estudo de uma populacão de 153 plantas de timbó macaquinho—*Derris nicou* (Benth.). **(Selection and improvement of derris. II. Study of a population of 153 plants of *D. nicou* Benth.).**
Bragantia 1959 : **19** : 273–305.

A population of the above species growing at

Belém was analysed for contents of rotenone and degueline. The plants fell into two groups as regards rotenone content: A, with less than 5% rotenone and B, with 9–20%. [Cf. 818].

FRUITS AND NUTS

Sixth Annual Report of the Scottish Horticultural Research Institute, 1958–1959. Pp. 74.

2465 *Wood, C. A. Pomology. (pp. 10–19).* Variety trials of red currant, black currant, strawberry, plum, apple, pear and cherry were carried out.

Raspberry. In two families where the female parents were raspberries and the male parents *Rubus chamaemorus* and King's Acre Berry, it was noted that the seedlings, while showing some segregation, appeared to resemble the maternal parents. The possibility that apomixis occurred in these crosses is being investigated. Although colonized by *Amphorophora rubi*, Norfolk Giant and Malling Exploit tend to resist infection by certain viruses transmitted by the aphid; seedlings of these varieties are being tested for field resistance to vein-banding disease.

Black currant. Of seed collected from 13 interspecific crosses, only that from Baldwin x *Ribes ussuriense* germinated well. Crosses between black currant varieties and nine species in the *Ribesia* subgenus of *Ribes* gave a total of 45 seedlings. Of 36 crosses between black currants and species from 5 other subgenera of *Ribes*, only four failed to set seed.

2466 *North, C. Vegetable culture. (pp. 20–27).* Varietal trials of French beans, broad beans, peas, Brussels sprouts, cabbage, broccoli, calabrese, spinach, celeriac, celery, parsnip-rooted parsley, carrot, beetroot, leek, winter lettuce and other vegetables are reported.

Brussels sprouts. One of the lines originating from hybridization between Ashwells, Amager and Cambridge Special was outstanding for its high yield of large dark-green sprouts. The inheritance of male sterility is being studied.

Cabbage. Selected lines from Danish Keeping x January King and January King x Ormskirk Savoy were self pollinated and sib crossed. White-flowered plants from a cabbage x broccoli cross were back crossed to cabbage. Lines from (1) Amager x January King back crossed to January King, and (2) January King x Slow Bolting IM2 were grown; the first contained some promising late-maturing material while the second was outstanding for uniform good-quality heads which matured about the same time as Christmas Drumhead.

Phaseolus. Lines from crosses of Record with Double Princess, Refugee and Fullcrop were further selected. New crosses were made between the dwarf varieties Double Princess and Refugee and the climbing variety Early Blue Lake. A few exceptionally vigorous lines from *Ph. vulgaris* x *Ph. coccineus* were grown; the hybrid strains combine the dwarf habit of the French bean with a pod flavour approaching that of the scarlet runner.

2467 *Swarbrick, T. Genetics. (pp. 34–35).* **Raspberry.** Plants bearing pollinated flowers were exposed to nitrous oxide under pressure in order to suppress the first division of the fertilized egg and induce polyploidy. Evidence was obtained that in at least one species of *Rubus* the first division may occur several days after fertilization.

Black currant. Among seedlings from interspecific crosses, some plants were noticed which, instead of being intermediate in leaf, gland and hair characters, resembled the maternal parent Baldwin. Similar black currant - like seedlings occurred when Baldwin was pollinated with *Ribes alpinum* and red currant, suggesting that apomixis may be occurring.

Brassica. Investigations of polyploid inheritance were begun with a study of meiosis in cabbage and Brussels sprouts. A single quadrivalent was found in 57% of PMCs of cabbage and in 39% of those of Brussels sprouts. Chiasma frequency was 1·51 per bivalent in the absence and 1·34 in the presence of a quadrivalent. The formation of quadrivalents in this material appears to be limited by the low frequency of crossing over.

2468 *Wilson, A. R. Mycology. (pp. 43–45).* Thirty-two isolates of *Botrytis cinerea* collected from tomato stems, petioles, leaves and fruit, varied considerably in gross appearance in culture. Preliminary tests indicate some variation in their ability to infect tomato stems through fresh leaf scars.

2469 *Reid, R. D. West Scotland unit (Auchincruive). (pp. 46–50).*
Strawberry. A high proportion of the seedlings produced by crossing the red-core resistant selection Auchincruive 11 with a strain of *Fragaria virginiana* showed an outstandingly high degree of field resistance to red core. Studies on the inheritance of immunity to this disease continued; analysis of results was

complicated by the production of susceptible runners by immune seedlings.

2470 *North, C., Frith, L. H. & Taylor, H. Variety trials of vegetables in Scotland. V. Spring-sown broad beans.* (*pp. 54–60*).
Tabulated information is given on yield, earliness, pod length, seed size and susceptibility to lodging of 39 varieties and strains which are grouped in seven categories based on seed characters. Varieties suitable for canning, freezing, fresh marketing and home gardening are listed.

2471 *North, C. & Taylor, H. Variety trials of vegetables in Scotland. VI. Hamburg parsley, 1957–1958.* (*pp. 61–63*).
Yield and quality trials of eight varieties are reported. The highest yielding were the Swedish variety Tidig vit Socker [Early White Sugar] and the Danish varieties Tyk Sukker [Thick Sugar] and Berliner; root quality was only moderate in the first variety but good in the last.

2472 *North, C. A review of recent researches on* Brassica oleracea. (*pp. 64–74*).
The following are discussed: varieties of Brussels sprouts, cabbage and cauliflower, with special reference to their performance in Scotland; breeding improved varieties; pests and diseases; and physiological studies.

Seventh Annual Report of the Scottish Horticultural Research Institute, 1959–1960. Pp. 72.

2473 *Wood, C. A. Pomology.* (*pp. 13–23*).
Variety trials of red currants, black currants, plums, apples, pears and cherries are reported.
Raspberry. Inbred families obtained by selfing firm-fruited selections from crosses of Malling Jewel with Burnetholm Seedling and Baumforth's Seedling B contain some lines with fruits which retain their firmness under weather conditions in which Malling Jewel fruits become soft. Inheritance studies on immunity to three soil-borne viruses were made; preliminary graft tests indicate that immunity in each case is a dominant character, simply inherited. Lloyd George and Malling Landmark appear to be heterozygous for immunity to raspberry ring spot and tomato black-ring viruses, and Malling Jewel is probably heterozygous for immunity to tomato black-ring and *Arabis* mosaic viruses. Crosses of these three varieties are being studied to determine whether the immunity genes are linked. Occasional tetraploid plants appeared in stocks of Malling Jewel, Malling Exploit, Malling Promise and East Malling seedling 69/139. In the last three varieties (the first has not yet been tested) tetraploids were less fertile than the diploids, producing unattractive fruits formed of a relatively few large drupelets; they were superior to the diploids however in thickness and strength of canes and fruiting laterals. Self-pollinated tetraploids are being grown. Some success in the production of polyploids by colchicine treatment of the roots is reported. Plants treated with nitrous oxide [2467] set variable amounts of seed; some plants were severely damaged by the low temperature of the gas.
Black currant. In crosses involving five subgenera of *Ribes*, ample seedlings were obtained from all *Eucoreosma* crosses except Baldwin x *R. floridum*; germination was poor in the case of the other four subgenera. By colchicine treatment of the stem apices of 40 seedlings of Baldwin x *R. maximowiczii* and 40 seedlings from selfed Wellington XXX, all at the cotyledon stage, 5 apparently polyploid or mixoploid plants (2 from the hybrid family, 3 from the inbred) were obtained.

2474 *North, C. Vegetable crops.* (*pp. 24–30*).
The results of varietal trials of French beans, broad beans, Brussels sprouts, cabbage, broccoli, calabrese, spinach, celeriac, celery, carrots, beetroot, leeks, winter lettuce and other vegetables are reported.
Brussels sprouts. Progenies from self-pollinated, partially male-sterile individuals included plants with only male-sterile flowers, plants with only hermaphrodite flowers, and a continuous series of intermediate forms with flowers of both types. Partially male-sterile plants maintained at 70–80° F. during the flowering period had a higher proportion of male-sterile flowers than those kept in an unheated greenhouse.
Cabbage. Plants derived from the crosses Danish Keeping x January King and January King x Ormskirk Savoy were further selected.
Phaseolus. Over 200 lines of F_4 and F_5 generations from crosses between the dwarf beans Double Princess, Record, Refugee and Fullcrop were grown; uniformity was good and very few showed signs of further segregation. Segregating lines from crosses between Record, Contender, Ženevská Trzní [Geneva Market] and Early Blue Lake were multiplied and preliminary selections made. In a wide range of material of different generations from crosses between *Phaseolus vulgaris* and *P. coccineus* varieties, single-plant selections were made from lines producing dwarf plants with stringless pods, some of them with pink flowers.

2475 *Haskell, G. Genetics. (pp. 42–47).*

Rubus. Somatic chromosomes were examined in root tips of *R. tomentosus* (2*x*), *R. ulmifolius* (2*x*), *R. caesius* (4*x*) and *R. procerus* (4*x*). A study of the haploid genome ($n = 7$) in a diploid plant of *R. tomentosus* from Switzerland showed that, with the exception of the nucleolar or satellited chromosome, where the centromere is subterminal, the chromosomes differ little from each other in size and form and have median or submedian centromeres. In diploid species a pair of satellited chromosomes is usually present, but in polyploids the number does not correspond to the degree of ploidy. Among the F_2 progeny of *R. craniensis* 'Merton Thornless' x *R. procerus* 'Himalaya Giant', a stunted seedling appeared which had very short internodes and thick rugose leaves of a very dark green colour, densely covered with hairs. Cytological examination revealed a mosaic pattern of chromosomes with numbers ranging from 9 to 46 per cell; variations in chromosome number occurred even within the same root tip.

Blackberry. The distribution and frequency of the species of the five sections constituting *Rubus fruticosus* agg. in Europe and Gt. Britain were studied. Distribution was found to reflect the limits of glaciation, with the diversity of species north of these limits falling off rapidly. Sections comprising the simpler forms are more widely distributed than those comprising complex types. Among the wild forms collected locally, the *Sylvatici* predominate, and the paucity of blackberries growing wild at this latitude (56° 30′ N) suggests that some very hardy species may be found in this collection. The mean segregation ratios in three F_2 progenies obtained by crossing *R. craniensis* with *R. procerus*, *R. calvatus* and *R. laciniatus* were 19·87 : 1, 26·33 : 1 and 24·31 : 1 respectively for the thorned-thornless condition. Genetical non-disjunction is significantly greater in the cross with *R. procerus* than with the others, and this cross gives unusually high numbers of thornless individuals. Thus, although the gene locus is at the same position on the chromosome in the three hybrids, segregation may differ due to other factors.

Black currant. Chromosome counts on root-tip cells of several cultivated varieties and species of *Ribes* showed the chromosome number to be consistently diploid ($2n = 16$); the chromosome complement consists of a pair of satellited and 14 symmetrical chromosomes. Black currant (*R. nigrum*) and *R. maximowiczii* genomes could not be differentiated in the somatic tissues of a hybrid between them. Leaf shape in the F_1 is intermediate, but the hairs are the same as those of *R. maximowiczii*; the glands found on black currant leaves are absent in the hybrid. Only one satellited chromosome was observed in the F_1 of a black currant x gooseberry cross; it is assumed either that the gooseberry genome lacks satellited chromosomes or that the satellites are inconspicuous.

Strawberry. In crosses involving a number of varieties, the lowest incidence of June Yellows occurred in Auchincruive Climax x Royal Sovereign (10%) and in the reciprocal cross (21%). Some crosses revealed large differences between reciprocals.

Tomato. Using three commercial varieties, a start was made on selecting for cotyledon number (pleiocotyly) to test for new polygenic combinations and to determine whether correlated responses to such selection will appear in other characters.

2476 *Reid, R. D. West of Scotland unit (Auchincruive). (pp. 60–65).*

Strawberry. Selection 52AC18, which has been grown for six successive years on soil infected with *Phytophthora fragariae*, shows no reduction in vigour nor any other above-ground symptoms of disease, although examination of the root systems each year confirmed the presence of some infection. Studies on the inheritance of immunity to *Ph. fragariae* continued. Plants which are immune to the second race and the Climax race now number 107 and 34 respectively; these were derived from resistant varieties, *Fragaria ovalis* and *F. virginiana*.

2477 *North, C. & Frith, L. H. Variety trials of vegetables in Scotland. VII. Celeriac, 1957–1959. (pp. 69–72).*

Field trials of 18 varieties revealed well-defined varietal differences in the tendency to bolt, this being least in Imperator, Invictus, Thompson and Morgan's celeriac and Globus. Invictus had the best-shaped bulbs. The bulbs of most varieties had cavities but those of Prager Kaempe [Prague Giant] were especially solid. For growing in Scotland Invictus is recommended, with Thompson and Morgan's celeriac and Globus also giving good results.

2478 STOLLE, G. & SCHURICHT, R.
Zuchtziele im sozialistischen Grossflächenobstbau. (**Breeding objectives for socialist large-scale fruit growing**).
Dtsch. Gartenbau 1960 : **7** : 232–34.

High, regular yields, lower production costs, capacity to withstand alternations of temperatures, disease resistance, wide range of adaptation, keeping capacity and fruit quality are mentioned as desiderata for the scion varieties, frost resistance, compatibility and standing capacity for the rootstocks.

2479 Tomcsányi, P.
Közvetett vizsgálati módszerek alkalmazása a gyümölcsfák fajtaérték bírálatára. **(The use of indirect testing methods for the estimation of the varietal value of fruit trees).**
KisérlÜgy. Közl. 1958 : *51C* : No. 3 : 5–29.

It is argued that, with the exception of yield data, much of the information provided by plot trials of fruit-tree varieties can be obtained in less time than is usually required for such trials. Further, since varietal value is dependent on yield, cost of production and market value [cf. XXVII, 2611 and XXXI, 821], and since the two last factors can be estimated only approximately, there is no advantage in determining productivity with great accuracy; indirect methods of estimating yield may therefore be adopted. Correlations between growth and wood characters on the one hand and commercially important attributes, including yield, on the other, are described from published work and from the author's own observations, and their use in evaluating varieties indirectly is discussed.

2480 Morettini, A.
Il miglioramento genetico degli alberi da frutto e sue recenti acquisizioni in Italia. **(The genetic improvement of fruit trees and recent acquisitions to the Italian varietal assortment).**
Frutticoltura, Bologna 1960 : **22** : 309–25.

A detailed review is given of recent Italian work on the breeding of vines, peaches, pears, plums, cherries and apples. Information is given on the parentage of numerous recently bred Italian varieties of these crops.

Föreningen för Växtförädling av Frukträd, Balsgård. Verksamhetsåret 1959. **(Association for Fruit-tree Breeding, Balsgård. Working Year 1959).**
1960 : Pp. 31.

2481 *Nybom, N. & Bergendal, P.-O. Kärnfrukter och bärbuskar. (Pome fruits and bush fruits). (pp. 7–13).*

Apple. Numerous crosses have been effected with a view to obtaining (*a*) late-ripening apples with good keeping quality, (*b*) scab-immune varieties, and (*c*) hardy varieties. Balsgård tetraploids have been crossed with introduced tetraploids. An apple from Ingrid Marie x William Crump has fine dark-red fruits which store well and are good in quality. Promising material has also been obtained from Ingrid Marie x Zuccalmaglios Renett, Zuccalmaglios Renett x Cortland and Åkerö x McIntosh. Delicious, Antonovka and Atlas have shown complete resistance to artificial infection with *Gloeosporium* in autumn, but all varieties were more or less susceptible when tested in spring. It has been confirmed that such varieties as Worcester Pearmain and Lord Lambourne transmit good mildew resistance to a large part of their progeny while the reverse is true for Cox's Orange, Ingrid Marie and Jonathan. Among radiation-induced mutant branches of Cox's Orange is one with redder fruits than usual.

Pear. Crosses have been made for late ripening and good keeping quality and for the study of the inheritance of red coloration. Other crosses include combinations of tetraploid seedlings of Moltke with tetraploids of Williams and Fertility. A 10% fruit set was obtained when tetraploid Fertility was pollinated with tetraploid seedlings of the apple Ribston. Among older material, Colorée de Juillet x Conference, Höstbergamott [Autumn Bergamott] x Clapp's Favourite, Doyenné du Comice x Johantorp and Esperens Herre (= Seigneur d'Esperen) x Herzogin Elsa have yielded promising seedlings. A russet mutant resembling Russet Bartlett has been found among irradiated Williams material.

Raspberry. Intervarietal crosses for hardiness, disease resistance and quality have been made. Crosses involving *R. occidentalis* and *R. occidentalis* x *R. idaeus* have been effected, also crosses between raspberry and blackberry. Promising material resistant to *Amphorophora rubi* is under study. The black-fruited species *R. occidentalis* is being used as a source of resistance to *Didymella applanata*. In quality tests, Mitra and its parent Pyne's Royal were rated best in flavour while Malling Jewel had the highest total points for colour, flavour and texture. There was some evidence of a correlation between dry-matter and vitamin-C content on the one hand and suitability for deep freezing on the other. A significant correlation was detected between flavour and colour, dark varieties being generally rated low because of acidity.

Ribes. The hardy and vigorous Canadian black currant Consort, carrying a gene for resistance to *Cronartium ribicola* derived from *R ussuriensis*, has been used extensively as a parent, as have also the *Pseudopeziza*-resistant Anger van Oeffelt and the late-flowering French.

2482 *Oldén, E. J. Stenfrukter, grundstammar, jordgubbar och hassel. (Stone fruits, rootstocks, strawberries and hazel). (pp. 14–20).*

Plum. Ruth Gerstetter, which transmits early ripening to its offspring, has been used in a number of crosses, as have also numerous other varieties. Among European plums, such self-fertile varieties as Early Laxton, Experimentalfältets Sviskon [Experimental-Field Prune], Ontario and Reine Claude d'Oullins [Oullins gage], have given fruits with viable kernels when pollinated by diploids, while self-sterile varieties such as Bonne de Bry, Hackman, Jefferson and Ruth Gerstetter have given only few fruits and very few viable seeds. In the reverse crosses, fruit set is good but only a small proportion have well-developed embryos. The combination Ontario x Ruth Gerstetter has yielded very promising early-ripening seedlings with large fruits which are mostly better in flavour than those of Ruth Gerstetter. La Crescent, a diploid which combines vigorous growth with hardiness and fairly good fertility, has given open-pollinated progeny with somatic chromosome numbers of 16, 24, 32, 40, 48 and 56, as well as one aneuploid with $2n = 41$. Two F_2 plants from the triploid hybrid of *Prunus salicina* ($2n = 16$) x *P. spinosa* ($2n = 32$) have proved to be hexaploid, while most F_2 plants had $2n = 40$. The diploids Santa Rosa and Formosa both produce a high proportion of unreduced pollen. Formosa, when used to pollinate a hexaploid, thus gave several plants with $2n = 40$ and also one with $2n = 56$. A plant with $2n = 56$ was obtained also from Pikestone ($2n = 16$) x Grand Duke ($2n = 48$).

Cherry. Numerous crosses have been carried out, the chief objectives being late-ripening, large-fruited Bigarreau types and early, firm-fruited varieties. A hexaploid hybrid [cf. XXX, 694] gave ripe fruits when pollinated with common Bigarreau varieties but not when pollinated with sour cherry. A tree from Erianne x Allmän Gullröd [Common Yellowish Red] and another from Napoleon x Erianne have yielded large red or dark-red fruits of fine quality. Also of interest are early-ripening seedlings with dark-red, fairly large fruits from Frogmore x Annonay, Annonay x Early Rivers and Rånna Halvbigarrå [Rånna Half Bigarreau] x Annonay. Roundel appears to give progeny free from bacteriosis; but also transmits small fruits.

Strawberry. Among crosses made in 1956 and 1957, Senga Sengana x Finn has yielded the greatest number of promising selections; Senga Sengana x Valentine has given some promising early material. In deep-freezing tests of 49 varieties, those which were rated best in quality included several Senga types, Carolina Superba and Dorsett.

2483 Tuinbouwkundig onderzoek. Jaarverslag 1959. (**Horticultural research. Annual report, 1959**).
Directie van de Tuinbouw, 's-Gravenhage : Pp. 365.

Besides the work referred to below, varietal trials and breeding progress are reported briefly for numerous other fruits, vegetables and herbs and also tobacco and potato.

Digitalis. New tetraploids of *D. purpurea* with a satisfactory content of active glycosides have been developed from C_0 plants. Triploid hybrids from $4n$ *D. lanata* x $2n$ *D. purpurea* proved sterile and crosses have now been made between $4n$ varieties of both species.

Apple. In breeding for resistance to night frosts, a few seedlings which so far have not flowered before 15 May have been obtained from the crosses Médaille d'Or [Gold Medal] x Jonathan, Crawley Beauty x Jonathan and Crawley Beauty x Cox's Orange Pippin, effected in 1949. Promising scab-resistant seedlings have been found among progenies from Jonathan x Antonovka and Cox's Orange Pippin x Antonovka; other crosses yielding promising seedlings include Golden Delicious x Ingrid Marie, James Grieve x Irish Peach, Cox's Orange Pippin x Golden Delicious and Golden Delicious x Sterappel [Star apple].

Carrot. Male-sterile plants giving 100% male-sterile progeny have been found.

Brassica. Japanese material of *B. nigra* x *B. oleracea* has yielded plants containing only *B. oleracea* chromosomes. They are largely self fertile and show no inbreeding depression on being multiplied.

Tomato. Plants resistant to *Cladosporium fulvum* and *Nicotiana* virus 1 have been obtained from the F_4s of V508 x Ailsa Craig and F514 x Abunda and the F_3 of V508 x Moneymaker. Three F_1 plants from *Lycopersicon esculentum* x *L. glandulosum* were more resistant to corky root than cultivated varieties but were sterile, while an F_1 plant back crossed to *L. esculentum* was fertile but susceptible. Lines homozygous for the dominant factors Cf_1 and Cf_2, governing a high degree of resistance to *C. fulvum*, have been developed by continued selfing of material from Potentate x *L. pimpinellifolium.*

Phaseolus. Lines from *Ph. vulgaris* 'Wade' x *Ph. dumosus* back crossed to Widusa have shown good pod characters and productivity in addition to resistance to all races of *Colletotrichum lindemuthianum*, *Phaseolus* virus 1 and *Pseudomonas phaseolicola*.

2484 CONSTANTINESCU, N. *ET AL.*
Soiuri de cireş şi vişin bune pentru zona de silvostepă şi de măr, păr şi prun pentru zona subcarpatică meridională. **(Varieties of sweet and sour cherry suitable for the woody-steppe zone, and of apple, pear and plum for the southern Subcarpathian zone).**
Grădina Via Livada 1960 : No. 5 : p. 34. (Abst.).

Recommendations for the above areas are made as a result of trials at the Istriţa and Voineşti research stations.

2485 NJAGU, M. [NEAGU, M. I.].
(Viticulture and horticulture in the Rumanian People's Republic).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : 59–60. [Russian].

Some high-yielding local Rumanian varieties of apple, pear and plum are listed. Mention is made of recent hybrids of fruit trees distinguished mainly by their high quality; these are now being introduced into Rumanian orchards.

VERMCE, V. S. (Editor).
Annual Report Fruit Research Station Saharanpur, Uttar Pradesh for 1957–59 : Pp. 164.

Section II—Research.

Breeding work on mango, citrus, litchi, loquat, guava, papaya, grape, custard apple, peach and *Grewia asiatica* is briefly outlined.

Section IV—Research Reports.

2486 *Singh, L. B. & Singh, R. N. Shy bearing habit of south Indian mango varieties and their sex-ratio.* (*pp. 54–57*).

Poor productivity in southern Indian varieties was found to be due, at least in part, to their very high sex ratios. Crosses of northern and southern varieties gave rise to hybrids with intermediate sex ratios and improved productivity. Fruit drop and the occurrence of functionless flowers also contributed to poor yields.

2487 *Singh, L. B. S1, a new promising selection of guava* (Psidium guajava *L.*). (*pp. 58–60*).

The fruit of this new selection, which appeared in a field of Allahabadi Safeda at the Horticultural Research Institute, has rougher skin than the parent variety and its pinkish-red flesh is of a coarser texture. It has a slightly lower ascorbic acid content but is said to be exceptionally sweet. The ratio of flesh to seed is higher than in the parent.

2488 *Seth, J. N. Technique for measuring and counting the stomata of* Psidium *species.* (*pp. 141–42*).

Thin layers of tissue stripped from the ventral surface of the leaves were boiled for 10–15 min. in 5–10% KOH. After washing in water the sections were transferred to lactic acid for 10 min. before again being washed in water. The sections were stained with an 0·1% aqueous solution of basic fuchsin and mounted in glycerine jelly. Stomata measurements made on leaves from various *Psidium* species showed a clear correlation between degree of ploidy and stoma size.

2489 GUSEVA, E. P.
(An orchard in the desert).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 5 : 13–16. [Russian].

An account is given of varietal trials of fig, almond and pomegranate in the arid Kyzul-Atrek district of Turkmenia. The fig varieties have 22% sugar in the fresh fruit and 74% in the dried product. Kadota was the most productive with a yield of 67 c. per ha. Desertnyj [Dessert], Jalta and Drake were among the high-yielding varieties of almond which had a high kernel extraction ratio and an oil content of 56–61%. Several good varieties of pomegranate are listed and a table shows their yields in 1957, 1958 and 1959.

Proceedings of the Caribbean Region. American Society for Horticultural Science. VI Annual Meeting, Cuba, June 1–8, 1958 : Pp. 32.

2490 *Soro, T. Nuevas variedades de aguacates de Puerto Rico.* (*New varieties of avocado from Puerto Rico*). (*pp. 8–10*).

Tabulated information is given on the following selections: Gripiña 5, 12 and 19; Semil 31, 34, 37, 43, 44 and 47; Isabela 2; and Meléndez 2.

2491 *Castro, M., Hernández, G., Medina, J. & Cásseres, E. H. Effect of variety and spacing on onion yields in Mexico in 1957.* (*p. 21*).

The variety White Grano, with an average yield of 20·3 tons/ha., outyielded three other varieties.

2492 *Niederhauser, J. S., Buck, R. W. (Jun.) & Akeley, R. V. Eréndira, a new potato variety, resistant to late blight. (pp. 22–23).*
[Cf. XXIX, 2821].

2493 *Ledin, R. B. Florida mango varieties. (p. 32).*
Varieties recommended for private and commercial cultivation are listed.

Proceedings of the Caribbean Region. American Society for Horticultural Science. VII Annual Meeting, San Jose, June 7–13, 1959 : Pp. VII + 88.

2494 *Richardson, R. W. (Jun.) & Cásseres, E. H. Two new sweet potato varieties for Mexico. (pp. 15–17).*
[Cf. XXX, 4095].

2495 *Vilanova, M. T.* et al. *Estudio preliminar sobre progenies de cafetos altamente productivos obtenidas en El Salvador. (A preliminary study on progenies of high-yielding coffee trees obtained in El Salvador). (pp. 22–35).*
As a result of a programme which began in 1949, considerable progress has been made in the selection of high-yielding élite trees. Details are given on the performance of these trees over a 5-year period. Some are of the Bourbon type, a number are *Coffea arabica* types, while the remainder are intermediate. The results of this study have indicated that the cultivated American coffees should be regarded as a population of hybrids.

2496 *Schneck, H. W. Breeding vegetables for local adaptation. (pp. 41–51).*
Some of the author's experiences in the breeding of improved vegetable varieties in Florida are described.

2497 *Reynolds, F. J. Papaya improvement in Honduras. (p. 57).*
Attempts to introduce resistance to cucumber mosaic virus in papaya through hybridization with the wild, resistant species *Carica pennata* are described.

2498 *Mortesen, E. Tomato variety trials in El Salvador. (pp. 58–68).*
Some resistance to early blight (*Alternaria solani*), the most serious disease affecting the varieties in these trials, was shown by De la Plata, Panamerica, Perón, Red Plum and Southland. The small-fruited varieties Roma, Red Top, San Marzano, VBL 3180 and Santa Cruz were virtually immune to cracking, while high resistance to this disorder was shown by Álamo, Chesapeake, Crackproof Pink, Glamour, Homestead 24 and Westernred.

2499 Sági, F., Zatykó, J., Kollányi, L. & Szilágyi, K.
Adatok Fragaria-, Grossularia-, Ribes- és Rubus-fajok és fajták azonosításához, valamint kemotaxonómiájához. (**Data on the identification and chemotaxonomy of species and varieties of *Fragaria*, *Grossularia*, *Ribes* and *Rubus***).
KisérlÜgy. Közl. 1959 : **52C** : No. 3 : 19–28.
Chromatographic analyses of organic acids, sugars, anthocyanins and carotenoids have been made in varieties pertaining to *F. grandiflora* and to four species of *Grossularia*, eight of *Ribes* and four of *Rubus*. In general, species could be distinguished from each other by means of the analysis but varieties within a species could not. On the assumption that similarities between chromatograms indicate the degree of relationship within a genus or species, a race of *Ribes petraeum* from the Caucasus appeared to be more closely related to *R. vulgare* and *R. rubrum* than to a race from the Vierlanden. The currant Hosszufürtő piros fajtajelölt [Long-strigged Red Varietal Candidate], obtained by open pollination, differed from other red currants both in morphology and pigment composition, and is thought to be an interspecific hybrid. *R. fasciculatum* contained carotenoids but no anthocyanins, while the reverse was true of all other *Ribes* species. An unidentified acid was found in two climbing blackberries, Lucretia (*Rubus baileyanus* x *R. argutus*) and *R. procerus* 'Theodore Reimers', but not in the American varieties Kittatinny and Lawton. *Rubus* appeared to be the least homogeneous genus studied.

2500 Grochowska, M., Grochowski, J. & Pieczara, J.
Uszkodzenia mrozowe drzew owocowych po zimie 1955–1956 r. (**Frost injuries in fruit trees in the winter of 1955–1956**).
Prace Inst. Sadownict. Skierniewicach 1959 : **4** : 173–206.
Observations on varietal differences in winter killing in apple, plum, pear and cherry in the severe winter of 1955–56 in Poland are recorded.

2501 Guzewska, I., Ostrowski, W. & Gdowski, J.
Doświadczenie nad przechowywaniem jabłek i gruszek w chłodni w trzech różnych temperaturach. (**Experiments on the cold storage of apples and pears at three different temperatures**).
Prace Inst. Sadownict. Skierniewicach 1959 : **4** : 340–64.

The storage quality of 11 apple and seven pear varieties was investigated at 0°, 4° and 8→0° C. The apples Beforest, Boiken, Famense, Landsberger Reinette and Signe Tillisch are noted as being particularly resistant to physiological storage diseases.

2502 Nieuwe appelrassen. (**New apple varieties**).
Fruitteelt 1960 : **50** : 1064–66.

In this account of some of the early varieties in the Netherlands varietal collection at Santacker, Elst, mention is made of a number of crosses. The variety McIntosh transmits its colour and flavour, but also its susceptibility to canker, to its offspring. A hybrid of Cox's Orange Pippin and Golden Delicious shows promise, as does also the hybrid Golden Delicious x Ingrid Marie. A bright red Golden Delicious type has been obtained from Golden Delicious x Sterappel [Star apple]. The hybrid James Grieve x Irish Peach has the flavour of James Grieve and keeps until February. Polyploids obtained so far have shown poor tree form, and seedlings from Antonovka, although resistant to mildew and scab, require back crossing to good commercial varieties before they are likely to become of value.

A pear selection from Précoce de Trévoux [Trévoux Early] x Beurré Giffard is described as a promising early variety.

2503 Semakin, V. P.
(**New forms within apple varieties**).
Priroda (Nature), Leningrad 1960 : No. 10 : 87–89. [Russian].

Studies on clonal variability of different varieties at Orel included observations on sports of Pepin Šafrannyj [Saffron Pippin] and Antonovka. The sport of the former has smaller fruits and leaves and thinner branches than the original form and transmits its new characteristics to its vegetative progeny. The other sport of Antonovka is distinguished from the parent variety by its turnip-shaped fruits; its vegetative progeny however was unstable, as only few plants had turnip-shaped fruits. Pollination by the initial varieties improved the fruit sets of the sports.

2504 Velkov, V.
(**A pomological study of the local apple variety Kurtovka**).
Nauč. Trud. visš. selskostopan. Inst. V. Kolarov (Sci. Trans. V. Kolarov high. agric. Inst.), Plovdiv 1957–1958 (1959) : **6** : 207–13. [Bulgarian].

Kurtovka [apple from Kurtovo] is a local variety of the Plovdiv province. Its quality is satisfactory and it is resistant to transportation and keeps until May or June. It is resistant to woolly aphid but susceptible to scab.

2505 (**The apple Mal't Bagaevskij**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : p. 41. [Russian].

The above variety, common in the province of Saratov, is described. It is a good cropper, resistant to frost, drought and *Physalospora obtusa*.

2506 Nesterov, Ja. S.
(**The chemical consistency and quality of flavour of apples in the southern zone**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : 22–23. [Russian].

Data are provided on the content of sugars and acids in apple varieties grown in southern Russia and studied at Majkop; the findings are discussed in relation to quality as eating apples or for processing. A few varieties rich in vitamin C are listed.

2507 Wilner, J.
Relative and absolute electrolytic conductance tests for frost hardiness of apple varieties.
Canad. J. Pl. Sci. 1960 : **40** : 630–37.

Conductance of diffused electrolytes from prehardened twigs has been found to provide a reliable means of testing hardiness at the Plant Research Institute, Ottawa, Ont. The association established between increased diffusion of electrolytes and increased injury to twigs was useful in determining the relative degrees of hardiness of three named varieties (Antonovka, McIntosh and Northern Spy) and also the absolute ratings for the ultimate frost resistance of their tissues.

2508 Millikan, D. F. & Guengerich, H. W.
Further observations on the scar skin disease of apple.
Plant Dis. Reptr. 1960 : **44** : 260–61.

In trials of commercial apple varieties Lodi, Minjon and Golden Delicious showed no symptoms and appeared to be tolerant of this disease. A mild off-flavour was noted in fruits from affected Golden Delicious scions.

Annual Report of the Agricultural and Horticultural Research Station, Long Ashton, Bristol, 1959 : Pp. 171.

2509 *North-Smith, G. A survey of perry pears in the West Midlands: III. North Gloucestershire. (pp. 68–70).*

Information is given on the names, synonymy and distribution of varieties in north Gloucestershire, England [cf. XXX, 3093].

2510 *Williams, R. R. & North-Smith, G. Perry pears and their characters: IV. (pp. 71–75).*

A further nine varieties are described [cf. XXX, 3094].

2511 *Crang, A. & Leach, M. The preserving qualities of some varieties of highbush blueberries. (pp. 151–54).*

The most satisfactory varieties were Burlington, Concord and Pemberton.

2512 Morettini, A.
Butirra Rosata Morettini (Incrocio Coscia x B. Clairgeau) . [**Morettini's Pink Beurré (Cross Coscia x Beurré Clairgeau)**].
Riv. Ortoflorofruttic. ital. 1960 : **44** : 343–46.

The new cultivar ripens several days before Williams and just after Santa Maria [XXII, 1385]. It bears fine fruits with a pink blush and excellent quality and gives unusually high yields.

2513 Pisani, P. L.
Contributo allo studio della biologia della fecondazione delle cultivar di pero Morettini. (**Contribution to the study of the biology of fertilization of the Morettini pear cultivars**).
Riv. Ortoflorofruttic. ital. 1960 : **44** : 355–62.

Data are given showing the sets of fruit from pollinating emasculated flowers of the early-ripening cultivars Butirra precoce Morettini [Morettini's Early Beurré], William precoce Morettini [Morettini's Early Williams], Butirra rosata Morettini [Morettini's Pink Beurré] and Santa Maria with a number of standard pollinators and with self pollen. Only Santa Maria proved self fertile. Open pollination gave better sets than artificial pollination in William precoce but less good in the others.

Suitable pollinators for each cultivar are indicated.

2514 Heinrich, H.
Zur Morphologie der Infloreszenzen einiger Birnensorten. (**The morphology of the inflorescences of some pear varieties**).
Diss. Landw. Hochsch. Hohenheim 1959 : Pp. 91. (Mimeographed).

The inflorescences of six varieties are described and mention is made of floral characters useful for distinguishing varieties.

2515 Zalewski, W.
Zawartość komórek kamiennych w miąższu gruszek jako kryterium ich przydatności do produkcji kompotów. (**Stone-cell content in pear pulp as a criterion of suitability for stewing**).
Prace Inst. Sadownict. Skierniewicach 1959 : **4** : 376–87.

No correlations have been obtained between organoleptic ratings of compotes made from eight different pear varieties and numbers (*a*) of stone cells and (*b*) of groups of stone cells per 50 mg. homogenized pulp. A new method in which the cellulose walls of the flesh are dissolved in Schweizer's reagent and the percentage of stone cells is determined by weight is described; this method has given fairly consistent values.

2516 Terpó, A.
Magyarország vadkörtéi (Pyri Hungariae). (**The wild pears of Hungary**).
Kertész. szőlész. Főiskol. Évköny. 1960 : **6** : 3–7.

This is a full account of work already summarized from another source [cf. XXX, 719].

2517 Rejman, A., Pieniążek, S. A., Szpunar, B. & Domańska, H.
Wstępne wyniki z sadu odmianowego grusz w Dąbrowicach. (**Preliminary results of a pear variety trial at Dąbrowice**).
Prace Inst. Sadownict. Skierniewicach 1959 : **4** : 3–21.

Among thirty varieties tested at Dąbrowice in central Poland, Kalebasa Płocka (= Grumkower Butterbirne [Grumkow Beurré]) was highest in yield, followed by Jałowcówka [Gin]; both were in the hardiest class, as determined in the severe winter of 1955–56.

2518 Brown, A. G.
Scab resistance in progenies of varieties of the cultivated pear.
Euphytica, Wageningen 1960 : **9** : 247–53.

Among 21 selections from progenies of intervarietal crosses, several were free from *Venturia* *pirina* in one locality but susceptible in another, suggesting that biotypes of the pathogen may have a sharply restricted distribution. The parent Durondeau was outstanding in the degree of resistance it conferred upon its progeny, and Fertility was also good, while Conference, Laxton's Superb and Williams generally gave highly susceptible progeny. No effect of rootstock on the blight reaction of a susceptible progeny was detected.

2519 VOGEL, W. & SCHÄR, E.
Eine gegen San-José-Schildlaus resistente Birnensorte. (**A pear variety resistant to San José scale**).
Schweiz. Z. Obst- u. Weinb. 1960 : **69** : 456–58.

The variety Coscia showed no sign of attack by San José scale in an orchard in Tirano, where Williams trees were heavily infested.

2520 COCIU, V. & MATEESCU, N.
Hibrizi de perspectivă la cais şi piersic. (**Promising hybrids of apricot and peach**).
Grădina Via Livada 1960 : No. 5 : 35–36. (Abst.).

Notes are given on the following, mainly recently bred, Rumanian varieties: (1) peach, hybrid 1 (a Voineşti local peach x Floare da mai [Mayflower], with large fruits and resistant to frost and diseases; hybrid 2 (same parentage as hybrid 1), with still larger fruits (124 g.); hybrid 3 (Cîndeşti x mixed pollen of 42 varieties), resistant to frost and *Taphrina*; and some disease-resistant seedlings obtained by open pollination; (2) apricot, Pioner, with fruits that transport well; Bucureşti 500, with flower buds highly resistant to frost; Centenural Unirii [Century of Union], an old high-yielding variety; Mărculeşti 19, with reddish purple fruits of good quality; Bărăgan 23, a late apricot; ICHV24, a late variety tolerant of temperature fluctuations; and Dobrogea nouă [New Dobrogea], a late variety whose fruits transport well.

2521 (**The apricot variety Krasnyj Partizan**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 5 : 37–38. [Russian].

Krasnyj Partizan [Red Partisan] has large fruits with an average weight of 65 g. Its other valuable characteristics are vigour, uniform late maturity and fruiting in the third or fourth year.

2522 NORTON, R. A.
New apricot varieties for Utah.
Fruit Var. hort. Dig. 1960 : **15** : 5–7..

Descriptions are given of seven varieties worthy of trial in Utah, including Utah 18, 27 and 32, which have been bred at the Utah Agricultural Experiment Station.

2523 VYSOCKIJ, A.
(**The Sizaja plum**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : p. 41. [Russian].

Sizaja [Dove-grey], so called because of the bloom on its purple fruits, is found in the Brjansk province. It is vigorous and resistant to fungi and has large fruits, which have a good flavour and transport well.

2524 VELKOV, V. & MARINOV, P.
(**Pomological studies of the more common local plum varieties in Bulgaria**).
Nauč. Trud. visš. Selskostopan. Inst. V. Kolarov (Sci. Trans. V. Kolarov high. agric. Inst.), Plovdiv 1957–1958 (1959) : **6** : 285–99. [Bulgarian].

The blue variety Kjustendil is the plum most widely grown in Bulgaria. Ripening in September, its quality is good and it may be used fresh or dried and for making preserves and brandy. Kjustendil transports well and is resistant to cold and susceptible to drought and disease. Bandačka is the next most common variety, often grown in dry regions. It ripens in August, has good transportability and good quality, being suitable for use as fresh fruit and for the manufacture of brandy. Debeljača [Coarse] is a local variety found in north-western Bulgaria and used mainly for brandy but also for the fresh and dried fruit. It is hardy but is attacked by *Polystigma rubrum* and *Prunus* virus 7. This variety ripens at the end of August and the beginning of September.

2525 MORETTINI, A.
La Ruth Gerstetter, cultivar precoce di susino meritevole di considerazione. (**Ruth Gerstetter, an early plum cultivar worthy of consideration**).
Riv. Ortoflorofruttic. ital. 1960 : **44** : 271–76.

The plum Ruth Gerstetter ripens in Florence at the same time as Florentia and Fertility. On account of the increasing interest in Italy for early plums, it is described and suitable pollinators are suggested.

2526 MICU, I.
Observaţii cu privire la polenizarea şi fecundarea florilor la pomi. (**Observations on the pollination and fertilization of the flowers of fruit trees**).
Grădina Via Livada 1960 : No. 5 : 39–41.

Data are provided on the fruit set obtained by pollinating the Tuleu gras [Plump Tuleu] and Anna Späth plums with pollen from various varieties at the Istriţa research station.

2527 Teterev, F. K. & Mel'nikova, K. D.
(The best plum varieties for making prunes).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : 20–22. [Russian].

Many varieties and seedlings of plum from Majkop equalled the standard varieties Vengerka Ital'janskaja [Italian Prune] and Vengerka Ažanskaja [Ažanskaja Prune] in prune quality and some were superior. A table giving the details of the prune-making quality of the best of these is provided.

2528 **Two new cherry varieties.**
Agric. Res., Wash. 1960 : **9** : No. 5 : p. 14.

Chinook and Ranier, respectively producing dark and light-coloured fruits, have been released cooperatively by the US Department of Agriculture and Washington State Agricultural Experiment Station. Ranier ripens 3–7 days earlier than Napoleon and Chinook 4–10 days earlier than Bing.

2529 **(The peach Narindži).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : p. 42. [Russian].

The above local Armenian variety, of which there are early and late-ripening forms, is described. It is of the north Chinese type, the flesh having a crunchy consistency. It is vigorous, early-bearing and resistant to *Sphaerotheca* and crops regularly every year. The fruit is large and its flavour good.

2530 Rudkovskij, G. P.
(New peach varieties).
Priroda (Nature), Leningrad 1960 : No. 11 : p. 114. [Russian].

New winter-hardy cultivars, differing in maturation period and with high quality fruit having white or yellow flesh, have been bred at the Kaščenko Botanic Garden in the Ukraine. Some were obtained by pollination with pollen mixtures or by vegetative hybridization involving sloe or apricot.

2531 P., B.
Una pesca precocissima: la "Madeleine Pouyet". **(Madeleine Pouyet, an extremely early peach).**
G. Agric. 1960 : **70** : p. 459.
Una nuova pesca precocissima la Madeleine Pouyet. **(Madeleine Pouyet, an extremely early new peach).**
Ital. agric. 1960 : **97** : No. 11 : xvii-xviii.

The peach described, a bud mutant of Mayflower selected and patented in France, is said to be superior to Mayflower in habit and in fruit quality. Ripening near Rome by 20 May, a week before Mayflower, it is resistant to the main diseases and free from fruit shedding.

2532 Singh, S. N.
Studies on the pollen germination of peaches.
Hort. Advanc., Saharanpur 1960 : **3** : 76–81.

Tabulated information is given on pollen-germination percentage and pollen-tube length of 10 peach varieties in a 10% sucrose solution. Saharanpur 1, Waldo, Bidwil's Early and Tinston gave the highest readings.

2533 Furr, J. R. & Armstrong, W. W. (Jun.).
Breeding citrus for cold hardiness.
Proc. Fla. hort. Soc. 1959 : **72** : 66–71.

An account is given of breeding to develop hardy scion and rootstock varieties in Florida, Texas and California.

2534 Ford, H. W., Feder, W. A. & Hutchins, P. C.
Citrus varieties, hybrids, species and relatives evaluated for resistance to the burrowing nematode, *Radopholus similis*.
Plant Dis. Reptr. 1960 : **44** : p. 405.

Of 950 varieties, hybrids, species and relatives of *Citrus* which have been evaluated since 1956 for resistance to *R. similis*, 97 are considered to be of doubtful value but will be retested, 39 have shown sufficient promise to merit greenhouse growth tests in infested and noninfested soils, and 6 have done well in greenhouse tests and are being evaluated as rootstocks in infested and noninfested citrus groves. These six are Rough Lemon A, Rough Lemon B, Clone X, Sanguine grosse ronde [Large Round Blood] and Pineapple–156 sweet oranges and Carizzo citrange. [Cf. XXIX, 681–3].

2535 Baines, R. C., Bitters, W. P. & Clarke, O. F.
Susceptibility of some species and varieties of citrus and some other rutaceous plants to the citrus nematode.
Plant Dis. Reptr. 1960 : **44** : 281–85.

Twenty-three of the 24 *Citrus* species tested for resistance to *Tylenchulus semipenetrans* were moderately or severely infected. *C. medica* 'Diamante' however was only lightly infected. Twelve varieties of *Poncirus trifoliata*, including diploid and tetraploid Frost, were examined. Argentina, Benecke, Christian, English, Texas and Towne were free of infection in pot tests; they have not yet been tested in the field. While tetraploid Frost was severely infected the diploid was attacked only slightly. Infection was light in Texas and Uvalde citranges, moderate in Carizzo, Cunningham, Morton and Troyer and severe in Coleman, Rusk and Savage. *Atalantia citroides* was infected lightly and *Cneoridium dumosum* very lightly. Infection was moderate in *Fortunella crassifolia* but severe in *Microcitrus australasica.* *Aeglopsis chevalieri*, *Afraegle paniculata*, *Balsamocitrus dawei*, *Clausena lansium*, *Murraya paniculata* and *Severinia buxifolia* were free of infection.

2536 MILELLA, A.
Le cultivar di arancio diffuse in Sardegna. **(The orange cultivars commonly grown in Sardinia).**
Riv. Ortoflorofruttic. ital. 1960 : **44** : 287–325.

Characteristics of the tree, leaf, flower, fruit and seed are presented for 19 cultivars, some of them blood oranges; only one variety of local origin, Ovale di S. Sperate, and six imported cultivars are considered worthy of further study.

2537 REECE, P. C. & GARDNER, F. E.
Robinson, Osceola, and Lee—new early-maturing tangerine hybrids.
Proc. Fla. hort. Soc. 1959 : **72** : 49–51.

Additional information is given on the above hybrids of the tangerine Clementine x tangelo Orlando [cf. XXX, 3123].

2538 SETH, J. N.
Causes of seedlessness in *Psidium guajava* L.
Hort. Advanc., Saharanpur 1960 : **3** : 82–88.

Meiotic abnormalities during microsporogenesis resulted in a very small proportion (18·4%) of viable pollen grains in the variety Seedless. This variety is thought to be of hybrid origin and exhibits self incompatibility of the gametophytic type.

2539 MONTENEGRO, H. W. S. & SALIBE, A. A.
Vitamina C em caqui (*Diospyros kaki* L.). **[(Vitamin C in kaki (*D. kaki* L.)].**
Rev. Agric., Piracicaba 1959 : **34** : 183–95.

The ascorbic acid content of 10 Brazilian varieties was determined. There were no correlations between ascorbic acid content, on the one hand, and Brix or seed number, on the other. The highest content was in the variety Coração de Boi [Ox Heart] (4·59 mg./100 g.).

50th Annual Report of the Northern Nut Growers Association. Annual Meeting at Illinois College, Jacksonville, Illinois, August 17 to 19th, 1959 : Pp. 148.

2540 *Best, R. B. Pecans in southwestern Illinois.* (*pp. 16–22*).

Tabulated information is presented on the yielding ability, maturity, quality of produce and disease resistance of 48 varieties.

2541 *Graves, A. H. & Jaynes, R. A. Chestnut breeding—report for 1958, and 1959.* (*pp. 62–71*).

A number of crosses have been carried out in a programme designed to breed a chestnut resistant to blight (*Endothia parasitica*). Three outstanding new hybrids have been released. They are Essate-Jap, [(*C. crenata* x ?*C. pumila*) x (*C. crenata*)] x *C. crenata*; Sleeping Giant, *C. mollissima* x (*C. crenata* x *C. dentata*); and Kelsey (*C. mollissima* x ?).

2542 *Sonnemann, W. F. My five years with persimmons.* (*pp. 112–15*).

Details on the performance of 44 varieties in Fayette County, Ill., are tabulated.

2543 KALMYKOV, S. S. & SABIROV, M. K.
(Early-bearing walnuts).
Priroda (Nature), Leningrad 1960 : No. 11 : p. 115. [Russian].

Mention is made of walnut varieties which have been selected for early bearing, frost resistance, good cropping and high quality of nuts from local Uzbek material. The selected forms, which include the variety Ideal, transmit the early-bearing habit to some of their progeny. Uzbekskij Skoroplodnyj [Uzbek Early-bearing], a seedling of Ideal, produces nuts superior in quality to those of its mother variety while resembling it in most other respects.

2544 BERRY, F. H.
Relative resistance of some chestnut species and hybrids inoculated with the blight fungus.
Plant Dis. Reptr. 1960 : **44** : 716–17.

Information is provided on the relative resistance of four *Castanea* species and 15 interspecific hybrids to *Endothia parasitica*. Resistance, as measured by low percentage of infected trees and smallness of canker size, was highest in the Chinese chestnut, *C. mollissima*. Although F_1 hybrids of *C. mollissima* x *C. dentata* were very susceptible, moderate resistance was noted in the F_2 and in back crosses of the F_1 with *C. mollissima*.

2545 Wouters, J.
Le noisetier en Italie. **(The hazel in Italy).**
Bull. tech. Ing. Serv. agric. 1960 : No. 155 : 737–39.

Varieties of hazel currently in cultivation in Italy are listed. Brief descriptions are given of the species and subspecies to which these varieties belong, namely *Corylus maxima, C. tubulosa* and *C. avellana* sspp. *grandis, glandulosa* and *racemosa*.

2546 Courtant, M. & Keller, G.
Le noisetier en Corse. **(The hazel in Corsica).**
Bull. tech. Ing. Serv. agric. 1960 : No. 155 : 727–35.

The varieties Impériale de Trébizonde, Grosse Ronde de Piémont [Piedmont Large Round] and Bâtarde [Crossbred], are described.

2547 De Rosa, M.
Varietà di nocciuolo. **(Hazel-nut varieties).**
Progr. agric., Bologna 1960 : **6** : 808–14.

Descriptions are given of the main varieties grown in northern, central and southern Italy respectively. Several of them are hybrids of *Corylus avellana* x *C. maxima* and are distinguished by resistance to frost, early ripening or high quality, either for roasting or fresh consumption.

2548 Schanderl, H.
Blütenbiologische Untersuchungen an deutschen Mandelsorten. **(Investigations on floral biology in German almond varieties).**
Erwerbsobstbau 1960 : **9** : 167–69.

Nineteen of the almond varieties investigated were self sterile and four were self fertile. The self-fertile forms showed hybrid characters and probably originated from crosses between peach and almond. Two varieties were sterile *inter se.* Suitable pollinators for some of the varieties are noted.

2549 Serafimov, S. S.
(Some structural characteristics of almond flowers).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 185–93. [Bulgarian].

Seedling trees in which up to 90% of the blossoms have additional ovaries have been found in the Pomorie area. Floral structure is otherwise normal, as is also fertility.

2550 Rigoni, V. A., Krapovickas, A. & Pietrarelli, J.
Las variedades cultivadas de maní en la provincia de Córdoba. **(The cultivated groundnut varieties in the province of Córdoba).**
Rev. Invest. agríc. B. Aires 1960 : **14** : 177–96.

Information is provided on the origin, distribution, morphology and yielding capacity of eight groundnut varieties.

2551 Pathak, G. N. & Singh, D. N.
Improved varieties of groundnut in Uttar Pradesh.
Indian Oilseeds J. 1960 : **4** : No. **4** : 239–50.

The results of yield and quality trials in four groundnut-growing areas of Uttar Pradesh are reported. Information is provided on three early selections, T32 (Dharwar–2), TMV–2 and AK12–24, and three late selections, T28, T11 and T33, all of which showed promise.

2552 Krapovickas, A.
Hibridación introgresiva en maníes de la región guaranítica argentina. **(Introgressive hybridization in groundnuts of the Guaraní region of Argentina).**
Rev. Invest. agríc. B. Aires 1960 : **14** : 161–75.

Further details are provided on the methods used and the results obtained in a study of groundnut populations in the Guaraní region of Argentina [cf. XXX, 3731 and XXXI, 866].

2553 Krapovickas, A. & Gregory, W. C.
Arachis rigonii, nueva especie silvestre de maní. **(*A. rigonii*, a new wild species of groundnut).**
Rev. Invest. agríc. B. Aires 1960 : **14** : 157–60.

A. rigonii, found in the Santa Cruz region of Bolivia, is described. It has a somatic chromosome number of 20.

2554 Krapovickas, A. & Rigoni, V. A.
La nomenclatura de las subespecies y variedades de *Arachis hypogaea* L. **(The nomenclature of the subspecies and varieties of *A. hypogaea* L.).**
Rev. Invest. agríc. B. Aires 1960 : **14** : 198–228.

Together with an enumeration of the 367 populations currently being grown at the Manfredi Experiment Station in Argentina, and an outline of previous attempts at classification, a description is given of 45 subspecies and botanical varieties of *A. hypogaea* [cf. XXX, 3730].

2555 FREZZI, M. J.
Enfermedades del maní en la provincia de Córdoba (Argentina). (**Groundnut diseases in the province of Córdoba, Argentina**).
Rev. Invest. agríc. B. Aires 1960 : **14** : 113–55.

Problems involved in the development of a variety resistant to leaf spot, *Mycosphaerella arachidicola*, are discussed. The variety Champaquí MAG, which was obtained by crossing Correntino 4 with a creeping Florida strain, has shown moderate resistance. A higher degree of resistance has been observed in a Virginia-type sample, obtained from Bolivia. A number of varieties which have shown some resistance to melanosis, probably caused by *Pleospora arachidicola*, are listed.

2556 NINAN, C. A.
Promising varieties and hybrids in coconuts.
Cocon. Bull. 1960 : **14** : 289–95.

The varietal collection at the Central Coconut Research Station, Kasaragod, Kerala, is described briefly. Among the lines which appear to be superior to the local variety are Laccadive Ordinary, S. S. Green, Fiji and New Guinea. Tall x dwarf hybrids came into production earlier than the parent West Coast Tall plants. The hybrids also gave higher yields but copra and husk quality were inferior. A group of "natural cross dwarfs", believed to be the result of outcrossing of dwarf types with tall males, outyielded the above-mentioned tall x dwarf hybrids. Crosses between indigenous and exotic varieties and also between different exotic varieties have been carried out. The most promising of a number of such crosses made earlier at the Agricultural Research Station, Pilicode, is Laccadive Ordinary x Gangabondam.

2557 **Annual Report of the Coconut Research Institute for 1958.**
Ceylon 1959 : Sess. Pap. 21 : Pp. 87.

A ten-year programme for breeding *Cocos nucifera* was drawn up, chiefly with the aims of high yield of copra and early bearing. The main lines of activity planned are (1) identification of "prepotent" palms by progeny trials, (2) paired crosses, (3) inbreeding, (4) collection and classification of varieties, (5) hybridization, (6) cytology, (7) correlations between juvenile and adult characters and (8) vegetative propagation. Already some work has been done on (1), (2) and (7).

Of the F_1s planted out since 1950, *typica* x King and King x *nana* are unsuitable for commercial exploitation, but *typica* x *nana* is probably capable of producing high yields of copra from the sixth year after planting. The superiority of *typica* x *nana* over F_1 *typica* x *typica* in giving high yields at an early age is considerable. Analysis of data collected from a progeny trial during the sixteenth to nineteenth years after planting indicated that the genetic correlations of flowering period with yields of nuts and copra were high and negative. The same data gave high heritability values for copra yield and weight per nut.

2558 THOMAS, C. A. & MATHEW, C.
A "trispatheate" coconut palm.
Cocon. Bull. 1960 : **14** : 256–59.

An abnormal coconut palm, found near the Central Coconut Research Station, Kayangulam, India, is described. The palm possesses three well-developed spathes in each inflorescence. It is pointed out that the 3-spathed condition affords greater mechanical protection for the inflorescence, without in any way prejudicing the normal yield of the palm.

2559 NINAN, C. A.
Some problems in resistance breeding in coconuts.
Cocon. Bull. 1960 : **14** : 251–55, 259.

The principal breeding techniques whereby disease resistance properties can be introduced into the coconut are discussed.

2560 SINGH, S. N.
Testing viability of papaya pollen in artificial medium.
Hort. Advanc., Saharanpur 1960 : **3** : 111–14.

A medium containing 5% sucrose and 1% agar was found to be most satisfactory for pollen viability tests.

Yearbook of the California Avocado Society 1960 : 44 : Pp. 146.

2561 *Report of the Avocado Variety Committee —1960.* (*pp. 23–26*).

Information on the varieties Bacon and Zutano is provided [cf. XXX, 763].

2562 *Sarasola, L. Cherimoya culture in Spain.* (*pp. 47–53*).

The following varieties of *Annona cherimoya* are described: Pinchudo, Campas, Negrito and Jete.

2563 *Delphey, C. C. Hybrid avocado trees being tested in Ventura County. (pp. 55–57).*
Tabulated information is given on the performance of 12 hybrid avocado lines in Ventura County, Calif. Promising results have been obtained from Fuerte x Hass and Fuerte x Mexicola hybrids.

2564 *Coit, J. E. Carob investigations; report of progress. (pp. 61–65).*
A number of indigenous and introduced varieties, which have shown promise in a carob demonstration orchard near Vista, Calif., are listed.

2565 *Zentmyer, G. A. & Mircetich, S. M. Results with new method of testing for resistance to Phytophthora root rot of avocado. (pp. 107–09).*
High resistance to *Ph. cinnamomi* was found in *Persea caerulea* and in *Alseodaphne* sp., an Asian plant related to the avocado. Neither of these plants is graft compatible with avocado. Moderate resistance was present in a number of compatible types, including certain Mexican, West Indian and Duke seedlings and cuttings.

2566 *Mircetich, S. M. & Zentmyer, G. A.* Rhizoctonia *seed and root rot of avocado. (pp. 119–20).*
An isolate of *Rh. solani* (*Pellicularia filamentosa*) from an unspecified citrus did not significantly affect avocado or *Persea indica* but five other isolates, all obtained from crop plants, were pathogenic. The symptoms induced varied from embryo destruction and cotyledon rotting to small lesions on the roots.

2567 *Schroeder, C. A. Progress report on the avocado breeding program at UCLA. (pp. 121–24).*
The present status of avocado breeding at the University of California, Los Angeles, is described. Although the variety Hass has proved highly satisfactory under a wide range of environmental conditions, it is somewhat susceptible to low temperatures. In an attempt to remedy this limitation, Hass has been crossed with Fuerte, Zutano and *Persea floccosa*. Selections from these crosses are being tested.

2568 HASKELL, G.
Some recent advances in Rubus genetics.
Sci. Progr. Lond. 1961 : **49** : No. 193 : 36–51.
"A review is given of some advances in the genetics of Rubus during the last decade. Particular attention is paid to fruit and seed anatomy, germination, the paucity of genes [so far detected], and the distribution and instability of chromosome numbers. The embryology of sexual and apomictic species is described, and the possibility is suggested of using apomixis to produce virus-free raspberry stocks. Factors influencing the breeding system are discussed. "It is suggested that the present-day heterozygous polyploid apomicts may carry within them (but 'genetically imprisoned') the original diploid genomes that have survived the last glaciation. If they could be released, diploid forms would be obtained that have *biologically* survived since this era, and might not be too different from the extinct primary diploids."
[Author's summary].

2569 GERTUCH, Z., OLEKSIAK, W. & KOSTRZEWA, Z.
Wartość produkcyjna 10 odmian malin w pierwszych latach owocowania plantacji w rejonie podgórskim. (**The productive value of 10 raspberry varieties during the first years of fruiting in plantations in the foothill region**).
Prace Inst. Sadownict. Skierniewicach 1959 : **4** : 41–52.
Data on yield, size and quality of fruit, duration of harvesting period, hardiness and incidence of *Didymella applanata* are given for ten varieties tested in the Carpathian foothills during 1955–57. Lloyd George was in the highest classes for yield, quality and fruit size.

2570 SZILÁGYI, K. & KOLLÁNYI, L.
E.401. Az új málnafajta. (**The new raspberry variety E401**).
KisérlÜgy. Közl. 1958 : **51C** : 79–83.
Developed at the Sopronhorpács-Fertőd Research Institute for Plant Breeding and Crop Production, Hungary, from the cross Superlative x Lloyd George, E401 is productive, ripens early and produces attractive medium-sized fruits with an excellent flavour and aroma, suitable both for dessert and for preserving. The variety is also being used as a parent in further breeding.

2571 URE, C. R.
Boyne raspberry.
Fruit Var. hort. Dig. 1960 : **14** : 73–74.
Released primarily for southern Manitoba, the red raspberry Boyne (Chief x Indian Summer) has been developed at Morden, Man. It has outyielded Chief and Latham, producing somewhat larger fruits than Chief, and has so far equalled or exceeded both these varieties in winter hardiness. Boyne is superior to Latham

in flavour and almost equal to Chief in sweetness. It is recommended for domestic gardens, and for supplying fresh markets and processing concerns locally.

2572 Knight, R. L., Briggs, J. B. & Keep, E.
Genetics of resistance to *Amphorophora rubi* (Kalt.) in the raspberry. II. The genes A_2–A_7 from the American variety, Chief.
Genet. Res. 1960 : **1** : 319–31.

In further investigations [cf. 877] at the East Malling Research Station, England, Chief has been found to carry three dominant genes, A_5, A_6 and A_7, each capable of conferring a high degree of resistance to strain 1 of *A. rubi*. It also possesses three genes, A_2, A_3 and A_4, for resistance to strain 2. A_2 is a dominant gene conferring adequate resistance by itself, while A_3 and A_4 are dominant complementary genes, neither of which by itself has any effect on resistance. A_5 is linked with either A_3 or A_4, with a cross-over value of 10%. A_1 from Baumforth A, giving resistance to strains 1 and 3, also confers resistance to strain 2 when combined with A_3. Thus the three strains at present recognized on raspberries in Great Britain may be controlled by means of either A_1A_2 or A_1A_3. Since six dominant genes for resistance have been identified in Chief, this variety must have arisen as an outcross of Latham (*Rubus idaeus* spp. *strigosus* x *R. idaeus* var. *vulgatus*) and not, as suggested by Brooks and Olmo, as a self of Latham.

2573 Shoemaker, J. S. & Sturrock, T. T.
Chromosome relations in blackberries.
Proc. Fla. hort. Soc. 1959 : **72** : 327–30.

With reference to work at the Florida Agricultural Experiment Station, characteristics of the $2x$, $3x$, $4x$, $6x$ and higher polyploid groups among blackberries are discussed, and the value of colchicine doubling of the chromosome number in crossing between members of the different groups is indicated, the methods of colchicine application and chromosome counting used at the station being described.

2574 Fry, B. O.
Early June, a new blackberry for the south.
Fruit Var. hort. Dig. 1960 : **14** : p. 74.

Early June (NC 36 x USDA 266), a semi thornless, early-ripening variety with good fruit quality, adapted to the southern region of the USA, has been released by the Georgia Agricultural Experiment Station.

2575 Sortsforsøg med solbær. (**Varietal trials of black currants**).
Tidsskr. Planteavl. 1960 : **64** : 353–56.

Data on yield, earliness, weight of 100 berries, vitamin C content and market value are given for 13 varieties tested at three stations in Denmark during 1955–58.

2576 Keep, E.
Amphiplasty in *Ribes*.
Nature, Lond. 1960 : **188** : p. 339.

At the East Malling Research Station, England, it has been noted that in three hybrids of *R. nigrum* x *R. grossularia* only one satellite is present at metaphase in root-tip cells, although each of the parental varieties, viz. the black currants Baldwin and Boskoop Giant and gooseberries Broom Girl and Green Ocean, contains two satellited chromosomes.

2577 Tóth, E. & Tóth, E. (Mrs.)
Kasztrálási és szigetelési kísérletek köszmétevirágon. (**Emasculation and isolation experiments with gooseberry flowers**).
Kertész. szőlész. Főiskol. Évkony. 1959 : **23** : 161–68.

In experiments conducted in 1954–56, Piros győztes [Red Victor] and Zöld óriás [Green Giant] strains were self fertile while Szentendrei fehér [Szentendre White] and Walhalla were highly self sterile. It was found best to effect emasculation before the flowers opened. Cellophane was more effective as an isolating material than tulle or vaseline. Piros győztes and Zöld óriás I both showed some tendency towards parthenocarpy.

2578 Sharpe, R. H. & Darrow, G. M.
Breeding blueberries for the Florida climate.
Proc. Fla. hort. Soc. 1959 : **72** : 308–11.

In breeding to develop varieties with a low cold requirement at the Florida Agricultural Experiment Station, the crosses (1) rabbit-eye blueberry [(*Vaccinium ashei* ($6x$)] x *V. darrowi* ($2x$) and (2) northern highbush blueberry ($4x$) x *V. darrowi* have given $2n = 48$ hybrids which have crossed readily with northern highbush varieties and other 48-chromosome parents. Some of the complex hybrids thus produced show promise as regards dormancy and fruit characteristics. To explain the origin of the $4x$ hybrids from (2), it is suggested that probably *V. darrowi* produced some unreduced gametes. Seedlings of highbush blueberry x ($4x$) *V. myrsinites* were badly delayed in growth and bore unattractive fruits.

Progress has also been made in improving rabbit-eye blueberries by controlled hybridization within the species and selection of open-pollinated material.

2579 OBERLE, G. D., MOORE, R. C. & HARDIGREE, J. B.
An unusual winter injury effect in high bush blueberries.
Fruit Var. hort. Dig. 1960 : **15** : 13–14.

A report is given on the pronounced varietal disparities observed at Virginia Agricultural Experiment Station in 1951 and 1959 with respect to a type of early winter injury, in which the leaf buds were apparently much more severely damaged than the blossom buds. Affected varieties showed a severe to medium failure in leaf development but bore good crops.

2580 DARROW, G. M., WHITTON, L. & SCOTT, D. H.
The Ashworth blueberry as a parent in breeding for hardiness and earliness.
Fruit Var. hort. Dig. 1960 : **14** : 43–46.

Tests of seedlings from crosses of Ashworth with Earliblue and other commercial varieties have indicated the value of the first-mentioned parent in breeding for resistance to low winter temperatures, frost resistance at blossoming time and early ripening. Ashworth has however the disadvantage of conferring susceptibility to witches' broom upon its hybrid seedlings.

2581 GOEDEGEBURE, L. & RUISSEN, J.
Aardbeirassenproeven. (**Strawberry varietal trials**).
Fruitteelt 1960 : **50** : p. 1321.

Data on yield and quality, together with notes on performance, are given for a two-year trial of nine varieties and a one-year trial of 15 varieties. Among the latter, the new variety Senga Precosa showed promise.

2582 BAUER, R.
Grundlagen und Methoden der Züchtung bei Gartenerdbeere (*Fragaria ananassa* Duch.). [**Principles and methods of breeding with the garden strawberry (*F. ananassa* Duch.)**].
Z. Pflanzenz. 1960 : **44** : 73–100.

In this review the following topics are dealt with: the distribution and economic importance of strawberries; breeding aims; and the variability and inheritance of important characters, including growth period, sex and fertility relationships, fruit qualities, characters affecting yield and disease resistance.

2583 BRINGHURST, R. S. & VOTH, V.
Larger strawberries through plant breeding.
Calif. Agric. 1960 : **14** : No. 2 : p. 8.

Selected seedlings from crosses of *Fragaria chiloensis* with commercial Californian varieties or selections have consistently produced exceptionally large fruits. Two of the hybrids have averaged 21·3 and 20·6 g. per fruit respectively, but some undesirable plant and fruit characters apparently associated with large size need to be eliminated by further breeding.

2584 KNECHT, A. & BLOMMERS, J.
Het nieuwe aardbeiras Vola. (**The new strawberry variety Vola**).
Fruitteelt 1960 : **50** : p. 953.

Developed at the Zaltbommel Trial Station, Netherlands, from the cross Bowa x Empire, the midseason outdoor variety Vola is highly productive, giving large, handsome fruits of good flavour suitable for fresh consumption. The calyces are not readily removed. Resistance to diseases appears to be good.

2585 (**Stepan Haritonovič Duka**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1960 : No. 8 : p. 62. [Russian].

This obituary of the Ukrainian plant breeder S. H. Duka refers to some of his varieties of fruit trees and strawberries. The latter include Kievskaja Rannjaja 2 [Kiev Early 2], Jubilejnaja [Jubilee] and Ukraine, which are rated highly for their earliness, high yield and fruit quality.

2586 HELTON, A. W.
A genetic abnormality in an Idaho clone of *Fragaria vesca*.
Plant Dis. Reptr. 1960 : **44** : 546–49.

Plants bearing minutely crinkled leaflets with fine chlorotic streaks running roughly in the direction of the veins were found. The symptoms were uniform throughout the plant and did not increase with time; all progeny plants developed the symptoms under all conditions to which they were exposed. Attempts to transmit the condition to indicator plants were not successful and it is concluded that the abnormal plants have arisen from a mutated clone of *F. vesca* var. *bracteata*.

2587 MATZNER, F.
Über die Variabilität wertbestimmender Inhaltsstoffe in Erdbeeren (*Fragaria grandiflora* Ehrh.) verschiedener Sorten. **[The variability of constituents determining quality in strawberries (*F. grandiflora* Ehrh.) of different varieties].**
Arch. Gartenb. 1960 : **8** : 50–71.

Varietal differences were found in specific weight and in the content of dry matter, total sugar, monosaccharides, disaccharides, cellulose, pectin, mineral salts, vitamin C and acids, there also being differences in the sugar-acid ratio. Mention is made of other factors influencing these properties.

2588 SCHURICHT, R.
Untersuchungen über den Einfluss von Fruchtgrösse und Ertrag auf die Leistung beim Pflücken von Erdbeeren. **(Investigations on the influence of fruit size and yield on the picking performance of strawberries).**
Arch. Gartenb. 1960 : **8** : 105–08.

It is shown that the relationship between the average weight of a single fruit (x_1), the yield per picking in g./m. (x_2) and the picking capacity in g./min. (y) may be expressed by the equation $y = a + b_1x_1 + b_2 \log x_2$. An estimate of picking capacity is useful in judging the value of a variety.

2589 MOORE, J. N. & VARNEY, E. H.
Varietal resistance to strawberry diseases.
Hort. News, NJ 1960 : **41** : 4082–83.

Information is given on the reactions of commercial varieties to races A–1 and A–3 of red core and to *Verticillium* wilt in New Jersey.

2590 CONVERSE, R. H.
Recent developments in strawberry red stele race distribution studies.
Fruit Var. hort. Dig. 1960 : **14** : 76–77.

Five races of *Phytophthora fragariae*, A–1 to A–5, have been identified in the USA. A–5 has been found only in experimental greenhouses where soils containing different races have been mixed together. A search is being made for sources of broader resistance than that based on Aberdeen, Frith or both these varieties, as is the case of all commercial varieties bred for resistance in the USA, with the exception of Siletz. The last-mentioned variety and a number of advanced breeding lines derive resistance from *Fragaria chiloensis* or *F. virginiana*, but most of the clones of these species so far used have proved susceptible to at least one race. The search continues for more resistant forms of these species and for ways of transferring the immunity found in closely related genera to the strawberry.

2591 MOORE, J. N. & HOUGH, L. F.
Strawberry breeding in New Jersey.
Fruit Var. hort. Dig. 1960 : **15** : 3–4.

Information is given on the achievements and aims of breeding at the New Jersey Agricultural Experiment Station, mainly with reference to resistance to *Verticillium alboatrum* and *Phytophthora fragariae*.

2592 VARNEY, E. H., MOORE, J. N. & SCOTT, D. H.
Field resistance of 29 additional strawberry varieties and selections to *Verticillium*, 1959.
Plant Dis. Reptr. 1960 : **44** : 370–71.

Cavalier and Siletz had the lowest disease ratings with no plants showing severe wilt symptoms. Selections NC2492, Md.US2700 and Md.US2640 and varieties Robinson and Grenadier were also highly resistant. Eight selections from a cross between two moderately resistant parents (Albritton x Md.US2101) varied greatly in their reactions, NC2492 being highly resistant, NC2475, NC2480 and NC2488 moderately resistant and NC2485, NC2494, NC2484 and NC2478 moderately to highly susceptible. [Cf. XXIX, 4429].

2593 CHANDLER, F. B. & DEMORANVILLE, I.
Cranberry varieties of North America.
Bull. Mass. agric. Exp. Sta. 1958 : No. 513 : Pp. 23.

Information is given on the chief characteristics of 56 varieties. A list of synonyms is included. The types of cranberries which may possibly be developed by breeding are indicated.

2594 SIMMONDS, N. W.
Notes on banana taxonomy.
Kew Bull. 1960 : **14** : 198–215.

These notes are based on work at the Imperial College of Tropical Agriculture, Trinidad. Two new species are described: *Musa ingens* from New Guinea and *M. beccarii* from British North Borneo. Information on several interesting members of *Musa* which have not yet been fully classified is summarized. A check list of species of *Musa* is provided. A discussion of records of *Ensete* in Asia is followed by remarks on generic characters of *Ensete* and an annotated check list of species of this genus. All species of *Ensete* so far counted have $2n = 18$; species of *Musa* have $2n = 20$ or 22, and exceptionally $2n = 14$ (*M. ingens*) or $2n = 18$ (*M. beccarii*). Chromosome number is thus not quite diagnostic of genus but is very nearly so. Apart from its chromosome number, *M. beccarii* is not in the least like *Ensete*. The number of $2n = 18$ thus appears to have originated twice.

2595 WAITE, B. H. & STOVER, R. H.
Studies on *Fusarium* wilt of bananas. VI. Variability and the cultivar concept in *Fusarium oxysporum* f. *cubense*.
Canad. J. Bot. 1960 : **38** : 985–94.

"The range in cultural variability of *Fusarium oxysporum* f. *cubense* on potato dextrose agar was studied. Several hundred isolates obtained from diseased varieties of *Musa* were categorized into four morphological groupings or cultivars. These were termed 'Sporodochial', 'Ropy', 'Cottony Alba', and 'Slimy Pionnotal' The morphological cultivar 'Sporodochial' was further divided physiologically into 'Odoratum' and 'Inodoratum' cultivars. Clones producing sporodochia were the parental forms from which all other cultural types could arise by mutation. Mutants did not revert to their parental types. A system is proposed for cataloguing clones of plant pathogenic *Fusarium* species. Based on morphological characters, the catalog is intended to serve as a collection of data which provides also for the categorizing of cultivars."
[Authors' summary].

2596 TRUEL, P.
Quelques problèmes d'encépagement. (**Some problems concerning vine varieties**).
Progr. agric. vitic. 1960 : **77** : 37–45, 108–17, 175–80, 195–99.

Observations made on a large number of grape varieties in various departments of southern France in 1957–1958 are reported. Information is given on the form and flavour of the fruit, structure of the bunches, susceptibility to rot, date of maturity and, in the case of some varieties, yielding capacity.

2597 CONSTANTINESCU, G. & NEGREANU, E.
Hibrizi de perspectivă pentru strugurii de masă cu coacere tîrzie. (**Promising late-maturing hybrids of dessert grapes**).
Grădina Via Livada 1960 : No. 5 : p. 15. (Abst.).

Twenty-five new hybrids have been obtained by the following breeding methods: sexual hybridization between selected parents; open pollination; and vegetative hybridization of Bicane grafted on Riparia x Rupestris 3309.

2598 TOADER, M.
Hibrizi valoroşi de viţă de vie obţinuţi prin hibridări sexuate. (**Valuable vine hybrids obtained by sexual hybridization**).
Grădina Via Livada 1960 : No. 5 : 15–16. (Abst.).

Useful hybrids have been raised at the Crăciunel viticultural research station from the following combinations: Iordană x Traminer roz [Pink Traminer], Iordană x Pinot gris [Grey Pinot], Galbenă de Ardeal [Ardeal Yellow] x Neuburger, Chasselas blanc [White Chasselas] x Galbenă de Ardeal and Italian Riesling x Galbenă de Ardeal. These crosses are of the type proles *pontica* x proles *occidentalis*.

2599 LEBEDEVA, L. JA.
(**Ways of improving the assortment of vines in Primor'e territory**).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. 4 : 40–42. [Russian].

Al'fa [Alpha] and Taežnyj Izumrud [Taiga Emerald] are winter hardy and give high yields but ripen later and have inferior flavour to some Far Eastern vines. A few Mičurin and American dessert varieties which transport well are recommended for introduction in districts where vines grow well. Mention is also made of some American varieties from Far Eastern collections which are interesting for their winter hardiness and resistance to pests and diseases, also varieties thought to be valuable as ♀ or ♂ parent for breeding new hybrids. Al'fa and Taežnyj Izumrud are among the Far Eastern varieties recommended as the ♀ components for crossing with early European varieties such as White Chasselas or with high quality cultivars from the Far East.

2600 SEFICK, H. J.
Bunch grape survival in upper South Carolina.
Fruit Var. hort. Dig. 1960 : **15** : 17–18.

Vitis species and hybrids showing outstanding vigour and longevity in the Piedmont area were indicated. Crossing and back crossing of long-lived vines with *V. vinifera* hybrids are under way to develop varieties with high-quality fruit and longevity.

2601 Blaha, J.
Posuzování sklizňového výnosu v individuální selekci révy vinné. (**Judging yield in individual selection of the vine**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Vyroba 1960 : **33** : 1275–86.

In judging the results of individual selection, it is necessary to calculate the average yield for all the lines and then determine the relative yield for each individual; the frequency of good yields can also be considered as a basis for selection. It was found in working with two varieties that six years of individual selection are required to produce results of practical use.

2602 Geisler, G.
Untersuchungen zur Frühdiagnose von Leistungseigenschaften in der Edelreis- und Unterlagenzüchtung bei Reben. (**Investigations on early diagnosis of performance characters in scion and rootstock breeding in grapes**).
Vitis 1960 : **2** : 117–33.

Investigations on the progeny of a cross between *Vitis vinifera* and *V. riparia* showed that the morphological characters of 10-week-old seedlings were not a reliable basis for selection since the characters underwent changes during further development. Early selection was however possible with one-year-old seedlings which had been pruned. Correlations were found between the characters of young seedlings and characters which appeared later; in particular leaf shape was correlated with various fruit characters. These correlations were mainly specific to the population studied.

The characters of seedlings growing in the open were evaluated both before and after the commencement of fruiting and were found to be indicative of future performance as rootstocks; a number of characters of the rootstock were found to influence the performance of the scion.

2603 P., E.
Anerkennung von Reben-Neuzüchtungen in Deutschland. (**Approval for new grape varieties in Germany**).
Schweiz. Z. Obst- u. Weinb. 1960 : **69** : p. 421.

Two varieties developed at the State Teaching and Experimental Station of Weinsberg have received official approval. Herold-Rebe [Herold grape] is a selection of Portuguese x Limberg and Blauer Weinsberger [Blue Weinsberg] is a combination between Frühburgunder [Early Burgundy] and Trolling. Both varieties produce red wine. In tests at Wädenswil they have not performed as well as they have in Germany.

2604 Blaha, J.
Základní charakteristika stolních odrůd révy vinné. (**Basic characters of table varieties of grape**).
Sborn. čsl. Akad. zeměd. Věd : Řada rostlinná Výroba 1960 : **33** : 1577–88.

Twleve varieties are compared with the standard Chasselas blanc [White Chasselas].

2605 Cosmo, I.
Vitigni ad uve da vino per i futuri impianti delle Venezie, Emilia e Lombardia. (**Grape vines for wine production for future planting in the Venice provinces, Emilia and Lombardy**).
Atti Accad. ital. Vite Vino, Siena 1958 : **10**; also Ann. Staz. Sper. Vitic. Conegliano 1958 : **19** : No. **1** : Pp. 71.

A study of 150 vine cultivars grown in the above regions was started in 1951. The present bulletin gives for each province a list of the varieties recommended for the different localities, with indications of the various synonyms under which they are known. Certain varieties whose cultivation is not recommended are also listed. A final list is appended in which the cultivars appear alphabetically under their main name, with indications of their areas of cultivation and their respective synonyms.

2606 Basamac, C. & Popa, E.
Bătută neagră—soi de mare producţie pentru obţinerea vinurilor roşii de consum curent. (**Black Bătută, a highly productive variety for producing red wines of the ordinary grade**).
Grădina Via Livada 1960 : No. **3** : 33–35.

A description is given of this Rumanian variety which has proved of value for the above purpose in experiments conducted at the Drăgăşani Viticultural Research Station.

2607 Olmo, H. P.
Plant breeding program aided by radiation treatment.
Calif. Agric. 1960 : **14** : No. **7** : p. 4.

The seedless grape variety Perlette, grown extensively in the desert areas of southern California, has the defect of tight clusters. Promising selections with looser clusters have been obtained as the result of treating buds with X rays, followed by grafting on older stocks. The mutants appear to be due to alterations in chromosome structure, which cause meiotic irregularities and thus a poorer set of the flowers.

2608 LEPĂDATU, V.
Studiul procesului de fecundare la viţa de vie în funcţie de diferiţi polenizatori. (**The study of the process of fertilization in the vine as a function of different pollinators**).
Grădina Via Livada 1960 : No. 5 : p. 18. (Abst.).

Pollen tube growth and fertilization in the maternal varieties Afuz-Ali and Coarnă neagră [Black Coarnă] pollinated by Muscat Ottonel or Hamburg Muscat or a 1 : 1 mixture of the two are described.

2609 CEJTLIN, M. G.
(**Horticultural methods and the quality of vines**).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1960 : No. **4** : 14–17. [Russian].

Supplementary pollination of varieties with perfect flowers by pollen mixtures or dusting the flowers with sulphur at the peak of flowering improved the size of bunches and grapes and increased the sugar content in Uzbekistan. Tables show minor varietal differences in response to these treatments. Information on the effect of spraying or dusting plants with compounds containing boron or phosphorus on the sugar content of a few varieties is also provided.

2610 BANIŢĂ, P. M.
Cloni de portaltoi selecţionaţi din populaţia Berlandieri x Riparia Teleki 8 B. (**Rootstock clones selected from the population Berlandieri x Riparia Teleki 8B**).
Grădina Via Livada 1960 : No. 5 : p. 16. (Abst.).

By clonal selection of the above rootstock, two improved vigorous clones, Drăgăşani 37 and 57, have been obtained at the Drăgăşani viticultural research station.

2611 ENĂCHESCU, G. & ALEXIU, A.
Contribuţii la studiul pigmentaţiei antocianice a principalelor soiuri de struguri şi vinuri roşii din R.P.R. prin cromatografia de hîrtie. (**Contributions to the study of the anthocyanin pigments of the principal grape varieties and red wines in the Rumanian People's Republic by paper chromatography**).
Grădina Via Livada 1960 : No. 5 : p. 28. (Abst.).

The method of analysing the anthocyanin composition of the berries of vine varieties and the wines obtained from them devised by Ribéreau-Gayon [XXX, 3190–1] has been applied to the principal varieties grown in Rumania, largely with the objective of distinguishing between wines from *vinifera* varieties and from direct-producer hybrids.

2612 GEISLER, G.
Die Bedeutung blattmorphologischer Merkmale für die Züchtung dürreresistenter Rebenunterlagssorten. (**The importance of morphological leaf characters for the breeding of drought-resistant grape rootstocks**).
Vitis 1960 : **2** : 153–71.

Observations of the ratio leaf area on one side/fresh weight, succulence (g. water/100 cm.^{2} leaf area on one side), the ratio dry weight/leaf area on one side and water content were made on *Vitis* species, cultivars of *V. vinifera* and seedlings of interspecific crosses. Leaf structure was clearly correlated with the ecological characters of the species. For example, xeromorphic leaves were found in *V. monticola* and *V. rupestris* which inhabit dry sunny regions, and *V. cinerea* from damp warm regions had mesomorphic leaves. The differences in leaf structure were not so great amongst European varieties; Riesling showed the most marked xeromorphic structure. Species and varieties differed in the extent to which leaf structure varied from year to year. With two exceptions the water content of the leaves was reduced when plants were grown under dry conditions in pots. The surface area fresh weight ratio of the leaves was differently affected by changes in water supply; in some vines there was a tendency for this ratio to increase under dry conditions. Amongst the interspecific crosses, resistance to drought was correlated with a small leaf surface area/fresh weight ratio. The leaf characters of seedlings showed similar values to those of their parents. Amongst seedling populations, the plants susceptible to drought reduced their leaf area/fresh weight ratio more than drought-resistant plants under conditions of water shortage. The correlations between leaf structure and drought resistance found in plants growing outside were also true of plants in the greenhouse.

2613 SOLOVEJ, G. T.
(**Methods of overcoming the dominance of the wild form in interspecific vine crosses**).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1959 : No. 9 : 18–23. [Russian].

Hybrids of *Vitis vinifera* with *Phylloxera*-resistant forms such as Riparia and Rupestris were raised at the *Phylloxera* research station of the Lenin Academy of Agricultural Sciences. The following methods proved effective in overcoming dominance of the wild form in respect of grape quality: (1) pollination of *V. vinifera* with pollen mixtures comprising resistant European cultivars + the wild resistant form, and (2) crossing *V. vinifera* with a *Phylloxera*-resistant form and selecting hybrids with the morphological characteristics of *V. vinifera* and back crossing these to *V. vinifera.* Hybrids obtained by these methods are listed. They include 15–3, distinguished by high yield, resistance to *Phylloxera* and grapes with the flavour of European vines. The berries have skin of an uncommon reddish-orange colour.

FOREST TREES

2614 Wright, J. W. & Finn, R. F.
A bibliography on forest genetics and forest tree improvement 1956–57.
Misc. Publ. US Dep. Agric. 1960 : No. 808 : Pp. 85.

This bibliography is arranged in alphabetical order of author's name and is completed by a subject index.

(Experiments and achievements in the breeding of forest species).
Sborn. Rabot Lesn. Hoz. 1959 : No. 38 : Pp. 299. [Russian].

2615 *Kudaševa, R. F.* (*Breeding* Phellodendron amurense *for industrial cultivation*). (*pp. 6–36*).

Details are given concerning the natural area of the species, its biology of flowering and growth, and the properties of its wood and cork. The thickness of the cork layer may vary from 5·3 to 15·5 mm. in 25-year-old trees and from 23 to 46 mm. in 110-year-old trees. Up to 940 g. of air-dry cork have been obtained from a single 20-year-old tree. Differences were observed both in the age at which cork began to be formed and the rate of its formation. The volume of 1 g. of cork also varied from 6·5 cc. to 2 cc. Only about 18% of the trees examined were classed as good in respect of the quality and quantity of the cork they produced; differences were also detected in the elasticity of the cork, corresponding to differences in histological structure which were easily demonstrated by phloroglucin staining, the most elastic samples being free from mechanical and parenchymatous tissues. In view of these wide differences, no seed should be planted without having undergone selection for yield and quality of cork; similar differences have been observed in growth rate, winter hardiness and growth habit, for all of which selection should be exercised. The trees with upright, unbranched trunks proved the most winter hardy and the best cork producers. Selected mother trees are pollinated with selected male trees, the technique of artificial pollination being described. Pollination should be carried out on dry days between 8 and 12 hr. Sets of 5–80% are obtained, the best being from mixed pollen from several male trees. Directions are given for producing seed from mixed plantations of selected mother plants and pollen parents and for reproduction of valuable material by vegetative propagation.

2616 *Kazarcev, I. A.* (*Production of poplars resistant to drought and salinity*). (*pp. 37–62*).

An outline is given of the interspecific hybridization work with poplars carried out in the Soviet Union. Special consideration is given to the species of the subgenus *Turanga* on account of their tolerance of drought, salinity and other unfavourable conditions of growth, particularly to *Populus diversifolia*, which is also frost resistant. The low seed production of the species in nature is ascribed to its diecious nature, combined with the fact that natural stands are often the result of vegetative multiplication from a single individual. Good seeds and seedlings have been obtained after cross pollination.

In making crosses on cut branches growing in pots the best results have been obtained when only 2–5 catkins, and no leaves, were left on the branch used as seed parent. The branches of *P. diversifolia* when used for pollen production require intensive illumination and a temperature of 20–25° C. No seeds set when *P. diversifolia* was used as seed parent and pollinated with a number of species belonging to subgenera *Eupopulus* and *Leuce*. On using *P. diversifolia* as pollen parent seeds were obtained only in crosses with *P. tremula*, the hybrid *P. tremula* '2835', and the hybrid Moscow Silver. The seeds produced from the cross with *P. tremula* were small and from 130 seeds 79 rather weakly seedlings were obtained, only 36 of which survived. From the pollinations of hybrid 2835, 35 seeds were produced and these gave rise to 28 seedlings. The most successful pollinations were those of the hybrid Moscow Silver, from a species of subgenus *Leuce* with

P. bolleana; 1009 seeds with high germinating capacity were obtained. These results are taken as indicating that subgenus *Leuce* is most closely related to the species of subgenus *Turanga*. The hybrids from Moscow Silver x *P. diversifolia* were the most vigorous in growth, those from the dark-coloured seeds being more vigorous and more winter hardy than those from the light-coloured seeds; by September some of the seedlings reached a height of 1·5 m. when grown in the very arid conditions of the Kalmyk Republic, their roots reaching a depth of 80 cm. The 35 best seedlings have been selected as élites and as parents for further crossing with species of subgenus *Turanga*.

2617 *Ivannikov, S. P.* (*Breeding aspens in the forest steppes for rapid growth, resistance to rot and wood quality*). (*pp. 63–124*).

Various advantages of *Populus tremula* over the oak are mentioned. Observations on the forms growing in the Soviet Union have revealed variation in bark colour and consistency, time of leaf emergence, size and form of catkins and other features but no correlation was found between these characters and timber quality. Selection has therefore been based on rate of growth, resistance to heart rot and timber quality. Descriptions are given of a giant clone found in the Obojan' area in the central forest steppe, the trees of which had a diameter of 60 cm. at breast height and were 30 m. tall, with few branches, a regular, pyramidal crown, large leaves and smooth, fine bark of greyish shade. The giant aspens were 17% higher than normal aspens growing alongside them and 50–70% greater in diameter. Only 2·5% of the trees were affected with heart rot and most were suitable for the production of high-quality timber. Comparisons at different ages showed that the giant form retained its capacity for maximum growth for a longer period than the common aspen.

No differences in the soil on which the giant and the normal aspens were growing could be detected. The length of the stomata was found to be 14·3% greater, the cells of the wood fibres 21% greater in length and the cells of the vascular bundles shorter and broader. The cells of the root meristem were some 100% larger in the giant form and their nuclei were 30–40% larger; their chromosome number proved to be $2n = 57$ as against $2n = 38$ in the normal form. The annual rings in the giant triploid had a higher proportion of mechanical and a lower proportion of conducting and storage tissue and this is regarded as the reason fo their greater resistance to heart rot; their yield of cellulose is also greater in consequence. Figures are presented showing that the technological properties of the wood of the triploid were good, the wood being stronger and more resistant than that of the diploid.

Several individuals of the diploid aspen free from heart rot were found in the vicinity of the triploid clone. They had tall, thick, upright trunks and had grey bark and a number of other features in common with the triploid clone. Both are females and are being used for propagating both clonally and by seed for the production of new cultivars. Seeds from open pollination of the triploid had a high germinating capacity and gave rise to vigorous and uniform seedlings, which exceeded those of the common aspen by 100% in height and by 38% in diameter.

Pollinations of the triploid and of the healthy diploid clones were effected on cut branches with 10–50 catkins which were allowed to flower in water indoors at a temperature of 16–18° C., on others, with 250–300 catkins, placed in a small stream out of doors, and on catkins forming on felled trees. The pollen was collected from cut branches of various aspens from other regions and from other species, 49 different combinations being made in the period 1953–55; a total of 23,084 hybrid seedlings were grown, 3793 of them being interspecific hybrids. One of the most successful hybrids was from the pollination of the triploid with another triploid aspen from northern Russia; some of these hybrids reached a height of 137 cm. in two years and added 260 cm. annually in the succeeding years. A number of dwarf seedlings, possibly tetraploids, also appeared. Pollination with normal aspens from various localities also gave good seedlings but those from an aspen from Tartary were small and slow in growth. Pollinations with poplars of the subgenus *Leuce* gave some good seedlings, the best of which attained a height of 170 cm. in two years; some dwarfs also occurred in these crosses; the majority of seedlings were however intermediate in characters, as were those with *P. canescens* and *P. bolleana*. Seedlings from *P. nigra* were more difficult to obtain and resembled those from open pollination; so did those from *P. pyramidalis*, except that their leaves were smaller and darker. Seedlings from *P. canadensis* were retarded in growth, as were those from *P. tacamahaca*. Mixtures of pollen of aspens from different localities produced a number of good seedlings, some of which gave annual growth increments of over 2 m.

2618 *Prokazin, E. P.* (*Breeding forms of Scots pine with high resin production*). (*pp.* 125–86).

An apparatus for boring into the bark and collecting the resin in graduated test tubes is described. With its aid determinations of resin flow were made on 1056 pines from different parts of the Soviet Union. Wide variations were observed between trees in a single plantation, some trees producing 5–6 times more than the average; 5–10% of the trees had over twice the mean value.

A correlation of $r = 0{\cdot}328$ was found between resin production and trunk diameter and of $r = 0{\cdot}275$ with height; the correlation with degree of tapering of the trunk was in the region of $r = 0{\cdot}4$. Thus great variations in resin production are possible within trees of equal diameter. The character of the bark, freedom from side shoots and width of crown were correlated with resin production in some cases and not in others. Needle density showed a negative correlation, sometimes amounting to $r = -0{\cdot}661$. The trees with the highest resin production were generally, though not invariably, those with the most rapid growth and development.

High fertility was generally correlated with high resin production. None of the above correlations was, however, sufficiently constant to serve as a basis for selection.

Anatomical studies of the wood of a number of individuals of *Pinus sylvestris* and *P. pallasiana* growing under similar conditions showed that, within each species, trees with high resin production usually had a greater number of resin ducts per unit area; however, *P. pallasiana*, though it is a higher resin producer, had lower density of resin ducts than *P. sylvestris*. The number of resin ducts in the needle tended to be higher in trees with high resin production and their needles were shorter and narrower.

The turpentine from the most productive trees generally had a lower specific gravity and refractive index. The turpentine from different races differed in the proportions of pinene to carene.

The buds of the productive trees were less susceptible to damage by organisms such as *Blastophagus piniperda*, *Fomes annosus*, *Pissodes validirostris* and *Dioryctria abietella*. Their roots were thicker and deeper, their cones were greenish or yellowish grey in colour, with a flat apophysis, and their seeds predominantly black, whereas in the unproductive they were mainly brownish or mottled. It is thought that cone form and colour of cones and seeds may provide a suitable basis for selection. The pines with the highest resin production produced about twice as many cones and three times as many seeds as the low resin producers; the seeds of the former had a greater energy of germination in most cases and retained their viability longer. The seedlings had a higher growth rate in the early stages, were less susceptible to attack by *Fusarium* and *Rhabdocline* and formed a stronger root system; like their parents they had a greater number of resin ducts in the wood and their branches were generally thicker. They grew more strongly when planted out.

It is recommended that all trees giving three times the average resin yield combined with rapid growth and good form of trunk and crown should be used as mother trees, being propagated first by grafting to form élite seed nurseries.

2619 *Skripicyna, N. E.* (*Breeding and seed production of* Euonymus maackii). (*pp.* 187–246).

The content of gutta percha in individuals growing under natural conditions proved slightly lower than that of *E. verrucosa* and *E. europaea* but the size of the bush is twice that of the latter species and four times that of the former. *E. maackii* is winter hardy in the Moscow area, since its growth begins somewhat later than that of the above two species or of *E. alata*, all of which are less hardy; they are also more susceptible to moth damage and give lower seed yields. Some individuals of *E. maackii* are 15–20 days later than others in all phases of growth; differences are also observed in habit, fertility and various morphological features but none were found to be correlated with gutta percha content. After a study of 248 seedlings growing in the vicinity of Moscow, 16 of them having gutta percha contents varying from 8 to 15% were selected. Similar observations on a number of 7–22 year old bushes planted in the arid Orenburg area showed *E. maackii* to be superior to *E. verrucosa* and *E. europaea* in seed production and from 238 plants examined, 50 were selected as having a gutta percha content varying from 8 to 20%.

An account is given of the floral morphology and biology; three types of bush were found, one on which the flowers produced no pollen, another in which pollen was produced but no seed, and a third in which the flowers were truly hermaphrodite; the three types differ somewhat in morphology but can be distinguished accurately only after the formation of flowers. Pollination is effected principally by flies. The best medium for pollen germination proved to be 20% sucrose agar. The pollen from the female-sterile forms germinated more vigorously than that from the hermaphrodites. Pollen maintained its viability for 3–4 days in moist chambers, 2 days in a desiccator with $CaCl_2$ but up to 40 days in a desiccator with H_2SO_4. Still better conservation was obtained by storing the flowering branches under snow. Differences in seed yield were observed between trees both in the "female" and the hermaphrodite forms.

The seeds of *E. maackii* had an oil content of 41·5–53·2%, those of *E. europaea* 42·6–53·3% and those of *E. verrucosa* 49·6–55·2%. The nondrying oil can be used for industrial purposes; a mean yield of 2500 seeds was obtained from 13–15 year old trees, so that the oil yield per hectare is calculated as being equal to that from sunflower.

Observations on pollination showed that isolation bags could be safely removed on the seventh day after pollination as the stigma was no longer receptive. Bagged emasculated flowers of *E. maackii* formed no seeds without artificial pollination. Interpollination of the hermaphrodite flowers raised the set from 20 to 34%. Pollination of unbagged flowers with a pollen mixture gave a set of 72%, compared with 57% from open pollination; the seed from mixed pollination also had a higher germinating capacity than that from open pollination or selfing. Pollinations with *E. verrucosa* gave no set, whereas *E. europaea* gave a set of 17%; the seeds germinated well and gave rise to more vigorous seedlings than those from selfing either species.

The best methods of growing seedlings and cuttings are outlined.

2620 *Zaikina, I. N. (Breeding maples in the conditions of the Moscow area). (pp. 247–99).*

Descriptions are given of *Acer saccharum*, *A. dasycarpum*, *A. rubrum*, *A. pennsylvanicum*, *A. spicatum*, *A. tegmentosum*, *A. mono*, *A. ginnala*, *A. barbinerve*, *A. pseudosieboldianum*, *A. mandshuricum*, *A. semenovii*, *A. campestre*, *A. pseudoplatanus* and *A. trautvetteri*. The species from the Far East are those which are most easily acclimatized in the Moscow area, the least successful being the European species. The Far-Eastern species are also interesting for ornamental purposes on account of their autumn colouring; in this respect *A. rubrum*, *A. pseudosieboldianum* and *A. platanoides* are mentioned specially. Variations in colour have been observed within each species, showing that scope exists for selection. Most of the forms with the most highly coloured foliage showed segregation for foliage colour in their progeny, though some of them bred true on selfing or when trees similar in type were interpollinated. A number of promising trees were selected on the basis of leaf coloration, frost resistance, rapid growth and form of crown.

Observations on floral structure and biology were made in a number of species. All those examined proved capable of producing viable pollen in cut branches placed in water, though the quantity varied with the species. *A. tataricum* and *A. ginnala* are mentioned as having hermaphrodite flowers, and *A. fraxinifolium* as being anemophilous and as having pollen that suffers least from late spring frosts. The pollen of most species could be kept viable at room temperatures for 10 days, in some species, such as *A. rubrum*, for up to 60 days. Storage over $CaCl_2$ gave longer viability.

In making interspecific crosses the set of seed was increased by using pollen mixtures when pollinating *A. platanoides* and *A. tataricum*, which otherwise gave very poor sets. No set was obtained in pollinations of *A. rubrum* with pollen mixtures, though hybrids were obtained from pollinating this species with *A. platanoides*, *A. fraxinifolium* and *A. barbinerve*. Hybrid seed was obtained from *A. fraxinifolium* in pollinations with *A. platanoides* and from *A. platanoides* in pollinations with *A. fraxinifolium*, *A. dasycarpum*, *A. rubrum* and *A. barbinerve*. Little or no seed was obtained in pollinations of *A. tegmentosum*, *A. tataricum*, *A. ginnala*, *A. dasycarpum* and *A. pseudosieboldianum*. From a total of 8000 pollinations 950 seeds were obtained. The germination capacity of the hybrid seeds was good, varying from 44 to 61%. Most of the seedlings resembled the maternal parent. The most frost resistant were those from *A. rubrum* x *A. fraxinifolium*. Some of the hybrids exceeded the control in height, those from *A. rubrum* x *A. platanoides* by 27–60%, those of *A. rubrum* x *A. fraxinifolium* by 26%. Hybrids of *A. fraxinifolium* on the other hand displayed no heterosis in height. One hybrid of *A. fraxinifolium* x *A. rubrum* was exceptionally vigorous and reached a height of 96 cm. in three years. The autumn coloration varied in the different hybrids but inclined towards that of the pollen parent.

Other hybrids obtained were *A. rubrum* x *A. negundo*, *A. platanoides* x *A. negundo*, *A. negundo* x *A. platanoides*, *A. tataricum* x (*A. platanoides* + *A. negundo*) and *A. pseudoplatanus* x *A. platanoides*.

2621 Arnborg, T.
Föreningen Skogsträdsförädling. Berättelse över 1959 års verksamhet. (**Association of Forest Tree Breeding. Report on activities during 1959**). 1960 : 1–27.

The work of the Swedish Forest Tree Breeding Association [cf. XXX, 1984] included provenance and progeny trials of oak, pine, spruce, larch, fir and *Thuja* at different stations in Sweden, as well as the work described below.

Aspen. Two interspecific F_1 hybrids free from *Valsa nivea* have been back crossed to the parents, *Populus tremula* and *P. tremuloides*, with the aim of investigating the occurrence of trees which are both resistant and satisfactory in growth and form.

Pine. Artificial pollination studies showed that blowing the pollen from a spray either from above or from the side of the female inflorescence was effective while blowing from below was unsatisfactory. At Sundmo, crosses between plus trees, between inbred lines and between trees of differing provenance have been effected.

2622 Brandt, K.
Skovtræforædling i Sverige. (**Forest tree breeding in Sweden**).
Hedeselsk. Tidsskr., Aarhus 1960 : **81** : 332–35.

This further account [cf. 2648] of a study trip to Sweden outlines work on the establishment of seed orchards and mentions that (*a*) the crosses Swedish x Continental spruce have proved superior to both Continental x Continental and Swedish x Swedish at Brunsberg and (*b*) northern x southern *Pinus sylvestris* has done better in both northern and southern Sweden than either parental type.

Proceedings of the 7th Northeastern Forest Tree Improvement Conference, held at Burlington, Vermont, August 18–19, 1959 (1960) : Pp. 69. (Mimeographed).

2623 *Zobel, B. J. Tree improvement and the southern forest industries.* (*pp. 9–15*).

The pine-breeding programme in North Carolina and neighbouring states is discussed. Over 500 superior trees have been selected for seed production.

2624 *Matthews, J. D. Forest tree breeding in Britain.* (*pp. 16–21*).

Aims, techniques and results are discussed in this review of forest breeding in Britain.

2625 *Rendle, B. J. Research on juvenile wood in Britain and its significance for forest tree improvement.* (*pp. 21–24*).

The term juvenile is used to denote the central core of wood in a tree. It appears that the anatomical characteristics of juvenile wood and the "duration of the juvenile period" are genetically controlled. Relatively small improvements in the quality and dimensions of the juvenile core in a tree population would considerably enhance the value of the crop.

2626 *Satoo [Sato], T. A brief report on forest tree improvement in Japan.* (*pp. 24–26*).

In this report particular reference is made to the improvement of *Cryptomeria japonica* by clonal selection.

2627 *Jaynes, R. A. Status of chestnut breeding at the Connecticut Agricultural Experiment Station.* (*pp. 27–31*).

Eleven species of *Castanea* are being used at the Connecticut Station in an attempt to breed a blight-resistant chestnut similar to *C. dentata* in stature and quality. The occurrence of heterosis in the progeny of certain crosses was confirmed; however it was noted that the success of a cross was less dependent on the species involved in the cross than on the particular trees used as parents. Thus crossing *C. crenata* x *C. dentata* did not necessarily result in progeny superior to both parental species in rate of growth. By crossing appropriate individual trees from each of the two species it was possible to obtain heterosis. There was evidence that an incomplete incompatibility mechanism might have been operative in certain crosses. Pollen of some species and individuals germinated at 30° C. in a 0·5% sucrose solution. Pollen of *C. henryii*, stored at 29° C. below zero for three weeks, showed 70–80% germination. Studies on factors determining blight resistance or susceptibility and on methods of vegetative propagation are in progress.

2628 *Gerhold, H. D. Seasonal yellowing of Scotch pine—its implications for the genetic improvement of Christmas trees.* (*pp. 43–47*).

Genetic and environmental factors which influence the yellowing of Scots pine needles are discussed. The heritability of needle colour is high and thus selection in a single generation, combined with vegetative propagation to produce seed orchards, would result in an appreciable improvement in needle colour. However, a programme embodying selection and controlled breeding over several generations may be expected to yield much better results, such as greater uniformity and a higher percentage of progeny possessing desirable needle colour characters in combination with other favourable traits. Problems involved in the development of such a programme are discussed.

2629 *Winieski, J. A. Artificial hybridization and grafting methods with* Ulmus americana. (*pp. 48–51*).

Wettstein's method of artificial hybridization was successfully used for intraspecific crossing in *U. americana* at the School of Forestry, Syracuse University, New York. The method consists of forcing dormant elm branches to flower in water-filled crocks in the greenhouse, collecting and storing pollen, and applying it to the female elements of other elm flowers when they are receptive.

2630 VAARTAJA, O.
Photoperiodic response in seedlings of five species of *Betula* and *Pinus*.
Canad. J. Bot. 1950 : **38** : 807–13.

The existence of photoperiodic responses has been experimentally established in *B. lenta*, *B. mandshurica* var. *japonica*, *B. glandulosa*, *P. lambertiana* and *P. monticola*.

2631 AL'BENSKIJ, A. V.
(Improving the existing forest trees and breeding new ones).
Agrobiologija (Agrobiology) 1959 : No. 5 : 774–76. [Russian].

This review of the introduction, Mičurinist training and breeding of forest trees in the USSR mentions quick-growing interspecific hybrids of poplars and willows. Also mentioned are large-coned hybrids of *Pinus sylvestris* from pollinations by other *Pinus* spp., and recent hybrids of *Quercus rubra* x *Q. robur* and *Juglans cinerea* x *J. niger* with larger fruits than the maternal species.

2632 BRAY, J. R.
A note on hybridization between *Quercus macrocarpa* Michx. and *Quercus bicolor* Willd. in Wisconsin.
Canad. J. Bot. 1960 : **38** : 701–04.

Acorns collected in southern Wisconsin from *Q. macrocarpa*, *Q. bicolor* and their hybrid *Q. schuettei* have been studied. It was found that cup fringe length, acorn length and acorn width were greatest in *Q. macrocarpa* and lowest in *Q. bicolor*, while the reverse was true for peduncle length. The hybrid was intermediate between the two parent species, but while it could be sharply separated from *Q. macrocarpa* on the basis of peduncle length data, there was evidence of introgression between it and *Q. bicolor*.

2633 MELVILLE, R.
A metrical study of leaf-shape in hybrids: II. Some hybrid oaks and their bearing on Turing's theory of morphogenesis.
Kew Bull. 1960 : **14** : 161–77.

"A metrical study was made of the leaf-shapes of the F_1 hybrid (*Q. lucombeana*) between *Quercus cerris* and *Q. suber* and of a particular F_2 hybrid of the same parentage (*Q. lucombeana* var. *diversifolia*).

"In the F_1 hybrid, graded interaction, with change of dominance between the parental effects, was observed along the leaf-axis.

"The F_1 hybrid leaf is narrower than the theoretical intermediate and the lateral nerves are skewed upwards. The reasons for these effects are discussed.

"Suppression of the lamina of the leaf to varying extents occurred in the F_2 hybrid. A sine-wave theory of leaf morphogenesis is proposed to account for these effects.

"The relationship between this sine-wave theory and Turing's Diffusion-Reaction Theory of morphogenesis is discussed." [Cf. XXX, 3409].
[Author's summary].

2634 PERRY, T. O. & WU, W. C.
Genetic variation in the winter chilling requirement for date of dormancy break for *Acer rubrum*.
Ecology 1960 : **41** : 790–94.

Observations on seedlings of different geographical origins in the USA revealed both racial and local variation in chilling requirement. Date of break of dormancy was strongly correlated with January and July average temperatures, duration of frost-free period and other temperature factors in the native habitats.

2635 GRAM, W. H.
Performance of seventeen poplar clones in south central Saskatchewan.
For. Chron. 1960 : **36** : 204–08.

FNS44–52, a natural hybrid of *Populus deltoides*, was the outstanding clone in the test, with a survival of 94% and height of 25 ft. six years after planting. Saskatchewan (natural hybrid of *P. deltoides*), BNW4 from *P. berolinensis* x (*P. deltoides* x ? *P. balsamifera*) and FNS44–52 displayed resistance to *Cytospora* canker and are therefore considered to be potential breeding stocks.

2636 JOKELA, J. J.
Heritability of traits in cottonwood trees.
Ill. Res. 1960 : **2** : No. 4 : p. 18.

A study is now in progress on the inheritance of economically important characters, such as growth rate and wood density, in wild populations of *Populus deltoides*.

2637 WETTSTEIN-WESTERSHEIM, W.
Eignungsprüfung von Aspen für die Anzucht von leistungsfähigem Pflanzgut. (**Testing aspens for fitness for raising productive planting material**).
Allg. Forstztg. 1960 : **71** : InformDienst forst. BundVerAnst. Mariabrunn No. 33 : unpaginated.

Using flowering branches removed from trees grown in the open, crosses between strains of *Populus tremula* and between *P. tremula* and *P. alba* were effected in the greenhouse at Schönbrunn, Austria. Measurements of height showed which trees were suitable for breeding. Hybrids between three aspens from Zirbitzkogel and one from Mönichkirchen showed the best growth performance and the least variation in height of all the aspen x aspen crosses and the losses were also low. Heterosis was observed in the crosses between aspen and white poplar; two aspens from the Lainz Tiergarten have been selected for further hybridization with *P. alba*.

2638 ELORRIETA Y ARTAZA, J.
Estudios de mejora de los chopos más interesantes de España. (**Studies on the improvement of the most interesting poplars of Spain**).
Rev. Inst. agríc. catal. 1960 : **109** : 112–22, 129–32.

An account is provided of the major characteristics of the sections of the genus *Populus* and of the economic species included in these sections. Detailed information is given on the history of programmes designed to improve *Populus* spp. in Spain and of importations of new selections from France, Italy, Canada and the USA. Reference is made to a number of recent developments. Campeador [Champion], a superior clone of *P. euramericana*, is now distributed throughout Spain. Promising hybrids bred at the Forest Institute for Investigations and Trials include the following: *P. deltoides* (Kansas) x *P. deltoides* ("carolino"), *P. deltoides* (Kansas) x *P. nigra* (pyramidal), *P. wislizeni* x *P. deltoides* (carolino), *P. tremula* x *P. bolleana*, *P. alba* x *P. bolleana*, *P. grandidentata* x *P. tremula* and *P. tremula* x *P. deltoides* (carolino).

2639 MELVILLE, R.
The names of the Cornish and the Jersey Elm.
Kew Bull. 1960 : **14** : 216–18.

The application of the International Rules of Botanical Nomenclature requires that the designation *U. stricta* Lindl. for the Cornish Elm be replaced by *U. angustifolia* (Weston) Weston var. *cornubiensis* (Weston) Melville. The Hampshire elm described by Goodyer as *Ulmus minor foliis angustis scabris*, and formerly designated *U. stricta* Lindl. var. *goodyeri* Melville by the author, is now redesignated *U. angustifolia* (Weston) Weston var. *angustifolia* (Weston) Melville. The Jersey Elm is thought to be a segregate of (*U. glabra* Huds. x *U. carpinifolia* Gled. x *U. plotii* Druce) x *U. angustifolia* and is renamed *U.* x *sarniensis* (Loud.) Melville.

2640 THALER, I. & WEBER, F.
Frühblühende *Aesculus*-Bäume. (**Early-flowering *Aesculus* trees**).
Öst. bot. Z. 1960 : **107** : 463–70.

A tree of *A. hippocastanum*, which always comes into flower early and also loses its leaves very late in autumn, is described.

2641 HUTTON, E. M. & BONNER, I. A.
Dry matter and protein yields in four strains of *Leucaena glauca* Benth.
J. Aust. Inst. agric. Sci. 1960 : **26** : 276–77.

Dry-matter and protein yields of the Peru strain of *L. glauca* were significantly greater than in three other strains, El Salvador, Guatemala and Hawaii.

2642 GRAY, S. G.
A study of variation, hybridization and the F_1 generation of interstrain crosses in *Leucaena glauca.*
J. Aust. Inst. agric. Sci. 1960 : **26** : 287–88.

This study has shown that *L. glauca* comprises a number of strains which are fairly uniform and stable, although not completely so. Strains may be grouped into three types on the basis of growth habit, vegetative vigour and time of flowering. The species is essentially autogamous but outcrossing occurs to a small extent. Interstrain hybridization studies have indicated that tallness is dominant over shortness; modifying factors also appear to influence height. Stem-tip pubescence is inherited as a single recessive and it is suggested that this character may be useful as a genetic marker. Petiole pigmentation appears to be influenced by one or two gene pairs. This character is however somewhat difficult to determine because of variation in expression.

Quantitative character differences have also been studied. The means for several quantitative measurements in the F_1 generation tended in a majority of instances to approximate those for the parent line with the higher value, indicating dominance as the major factor in controlling size inheritance. Some instances of F_1 means exceeding those of the higher parent indicated heterosis. There were indications that the strains of *L. glauca* possess differences in combining ability.

2643 CLIFFORD, H. T.
Seed production in a wild Eucalyptus hybrid.
Aust. J. Sci. 1960 : **22** : p. 483.

From the limited data available, it would appear that hybrids between *E. elaeophora* and *E. goniocalyx* are highly fertile and that the two species are closely related. It is suggested that further data on seed production and fertility of other wild hybrids would be useful for a proper understanding of interspecific relationships in the genus as a whole.

2644 PILIPENKO, F. S.
(In search of the ancestor of eucalyptus).
Priroda (Nature), Leningrad 1960 : No. 8 : 95–97. [Russian].

A comparative morphological study of *Eugenia cordata* (= *Syzygium cordatum*) and *Eucalyptus shirleyi* suggests that they are distantly related forms, the former being regarded as an ancestor of *Eucalyptus* forms resembling *E. shirleyi*.

2645 SUDA, Y.
The number of chromosomes in some Japanese salicaceous plants. III.
Sci. Rep. Tôhoku Univ. : Ser. IV 1960 : **26** : 25–36.

The following n numbers are reported: *Salix futura, S. shiraii, S. integra, S. koriyanagi*, 19; *S. hondoensis, S. babylonica, S. aegyptiaca*, 38; and *S. reinii*, 76 [cf. XXIX, 768 and 4495]. *S.* x *euerata* had $2n = 57$. The occurrence of heterochromosomes in *S. integra* is considered to be doubtful. Secondary association has been observed in all eight species. Meiosis in *S.* x *euerata* is described.

2646 WETTSTEIN-WESTERSHEIM, W.
Trockensubstanzuntersuchung als Methode der Selektion umweltangepasster Weiden. (**Investigation of dry matter as a method of selecting willows adapted to the environment).**
Allg. Forstztg. 1960 : **71** : InformDienst forst. BundVerAnst. Mariabrunn No. **33** : unpaginated.

Data provided on the dry matter content of canes of 14 clones grown at Tulln and Gmunden, Austria, show which clones are adapted to each district, the climate differing markedly in each place. *Salix purpurea* x *S. repens* had most dry matter in both districts.

2647 WELLWOOD, R. N.
Specific gravity and tracheid length variations in second-growth Western hemlock.
J. For. 1960 : **58** : 361–68.

Trees of *Tsuga heterophylla* having tracheids either initially shorter or longer than average tend to retain this character as they grow older and this appears to be a genetic effect.

2648 Skovtræforædling i Sverige. (**Forest tree breeding in Sweden).**
Hedeselsk. Tidsskr., Aarhus 1960 : **81** : 321–26.

In this account of a visit to Sweden, it is mentioned that in an experiment at Bogesund, in which various combinations between two plus and two minus pines were studied, the progenies of plus x plus crosses were much superior to all other progenies; minus characters were dominant, so that both minus x minus and minus x plus progenies showed poor growth.

2649 ZENTSCH, W.
Besteht ein Zusammenhang zwischen dem Saugkraftvermögen von Kiefernsamen und dem Standort? (**Does a relationship exist between the osmotic capacity of pine seed and the locality ?)**
Naturwissenschaften 1960 : **47** : 382–83.

Seeds of 14 pines from damp districts and 14 from dry districts were germinated in water and in a glucose solution. Marked differences between individual trees were observed in germination and further development but no effects of the original environment could be distinguished.

2650 THORBJORNSEN, E.
A cone production study in loblolly pine on the Coastal Plain of North Carolina.
J. For. 1960 : **58** : 543–47.

It was found that cone production of selected superior trees of *Pinus taeda* is not inferior to that of ordinary crop trees. The association between diameter at breast height or stem volume and cone production is significant at the 0·1% level and about ⅓ of the total variation in cone production is accounted for by either of these variables. Total tree height also shows a highly significant association with cone-producing ability but accounts for only 13% of the variation in fecundity. The correlation coefficient between branch volume and cone production is significant at the 0·1% level but the yield of cones becomes abruptly constant at a branch volume of about 4 cu. ft. The length of the live crown is correlated with cone production but the crown length : tree length ratio does not provide an estimate of cone production. The numbers of old cones give some indication of future production.

2651 KIELLANDER, C. L.
Svensk gran och kontinentgran. (**Swedish spruce and Continental spruce**).
Svenska SkogsvFören. Tidskr. 1960 : **58** : 193–204.

This is a fuller account of work already summarized from another source [XXX, 4340].

2652 PANIN, V. A.
(**Early and late forms of spruce**).
Les. Hoz. (Forestry) 1960 : No. **7** : p. 17. [Russian].

Forms of *Picea abies* differing in growth periods were found on a forest farm in the Vologda province. The late phenotype has greater economic value as it escapes spring frost and damage by the nun moth. Its timber quality is also superior.

2653 POLUBOJARINOV, O. I.
(**A spruce form with narrow crown**).
Les. Hoz. (Forestry) 1960 : No. **11** : p. 94. [Russian].

The above form, found in Leningrad province, is thought to possess breeding value, as it is resistant to damage by strong wind and heavy snow. A 160-year-old tree had a trunk 27 m. high, with a diameter of 48 cm.

VEGETABLES

Tenth Annual Report of the National Vegetable Research Station, Wellesbourne, Warwick 1959 (1960) : Pp. 63.

2654 *Haigh, J. C. Plant breeding report.* (*pp. 15–19*).

Red beet. Lines have been selected which show marked resistance to bolting even under conditions tending to encourage it.

Onion. A preliminary test of hybrid material is reported, the hybrids used being crosses of male-sterile K_1 lines and second-generation inbreds of the variety Cambridge 10. Germination and emergence were better in the hybrids than in parental K_1 and Cambridge 10, the controls, but the yield results were not conclusive.

Cabbage. Progeny tests of January King have demonstrated considerable variations between different progenies. Plants have been selected for breeding towards a smaller type of January King with a reduced number of rosettes.

Cauliflower. Studies on the breeding system have indicated that the early summer types are generally self compatible, while the autumn and winter types are self incompatible. However, even the most self-compatible variety did not give a full seed set on selfing and the most self-incompatible variety did set some selfed seed.

Brussels sprouts. Further tests have been carried out on the performance of hybrids between selected plants of different lines of Cambridge Special [cf. XXX, 836]. The hybrids have generally given considerably higher yields than the parent plants. Work is now under way to compare various methods of hybrid seed production under field conditions.

2655 Neuheiten für die Branche. (**Novelties for the trade**).
Saatgutwirtschaft 1960 : **12** : 270–71.

Radish. Parat is particularly resistant to pithiness; the root has a dark carmine-red skin and white flesh. It has a good mild taste.

Jerusalem artichoke. Topianka has foliage suitable for ensilage.

Brussels sprouts. Huizer's Abunda, previously known as Huizer's Original, is a tall vigorous variety which develops late; the sprouts are dark green in colour, firm and closed. This variety shows good resistance to frost.

Spinach. Wisemona is monecious; it grows quickly, has a long period of harvest and is winter hardy. This variety is particularly suitable for deep freezing and has a good taste.

Lettuce. Hilmar is a cabbage lettuce suitable for forcing; it is ready for cutting well before

Maikönig Treib [May King Forcing]. This variety is not adapted for outdoor cultivation. Its head is large and firm and of an attractive yellowish green colour.

Endive. Golda is a smooth-leaved winter variety which blanches well; the heart leaves are of a bright yellowish-green colour.

Bean. Prelude is a dwarf variety; the dark green, stringless pods have white seed and ripen early.

2656 Neuheiten für die Branche. (**Novelties for the trade**).
Saatgutwirtschaft 1960 : **12** : 302–03.

Beetroot. Formanova has a cylindrical root with a diameter of 5–7 cm. Its flesh is blood red in colour and without rings. This variety is particularly suitable for canning; it can be cut up into slices all of equal size and there is no waste. Also Formanova is easily harvested.

Radish. Quick is a white forcing variety suitable for cultivation in frames and outside. It resembles Halblanger weisser Treib [Medium-long White Forcing] and Freiland [Open Ground] in form and development.

Tomato. Lintorpa Prinzess is a mid-early bush variety with medium-sized fruit, which colour brownish red when ripe.

Bean. Probator is a dwarf variety with green stringless pods and white seed; it is similar to Doppelt Holländische Prinzess [Double Dutch Princess] but is more vigorous, productive and resistant to disease. Probator is particularly resistant to bean mosaic virus 1. The pods have good flavour and good canning quality.

Pea. Pixie is a small-seeded shelling variety of the Vorbote [Forerunner] type; it is shorter than Vorbote. Its resistance to *Fusarium* is noteworthy and it is suitable for canning and for use as a fresh vegetable. It ripens early and gives high yields.

2657 WALL, J. R.
The production and future of hybrid vegetables.
Proc. Fla. hort. Soc. 1959 : **72** : 217–20.

Methods of producing F_1 hybrids on a commercial scale are outlined and the role hybrid varieties may be expected to play in the vegetable industry in the future in the USA is indicated.

2658 LAMM, R., TOMETORP, G. & ÅVAL, H.
Klassificerande sort- och stamförsök med köksväxter 1957–59. (**Classificatory trials of strains and varieties of vegetables, 1957–59**).
Medd. Trädgårdsförs. 1960 : No. 132 : Pp. 25.

The following new varieties and strains are among those awarded first-class rank in the above trials, held at Alnarp and other Swedish stations: the string bean Blanka/59 (Jätteslagsvärd [Giant Sword] x Kaiser Wilhelm), which gives high yields of well-filled pods; the brown-seeded dried-bean variety Cita/59, also high yielding; Dvärgsabel II/59 [Dwarf Sabre II/59], a white-flowered sugar-pea mutant which has a finer flavour than the original variety Dvärgsabel/56; and the high-yielding winter dill Sylvester OE/59, for greenhouse cultivation, which produces more and larger leaves per plant than other strains.

2659 APELAND, J., PERSSON, A. R. & HOVD, J.
Stammeforsøk med knollselleri. (**Strain trial of celeriac**).
Meld. Inst. Grønsakdyrk. undated : No. 11 : Pp. 7.

Data are given on the yields of roots and leaves and appearance and quality of the roots of 20 varieties tested in Norway. Descriptive notes are given on seven recommended varieties.

2660 AXELSSON, F.
Selleri Tellus Weibulls original. (**The Weibull original celery Tellus**).
Weibulls Allehanda 1960 : **20** : 19–21.

The above celeriac, developed from crosses involving an earlier variety of the same name, has received first-class ranking in state trials. It gives high yields and the bulbs are smooth, with little tendency towards hollowness of the neck. It is sensitive to boron deficiency.

2661 PUTRAMENT, A.
Studies on self sterility in *Raphanus sativus* (L.) var. *radicula* (DC).
Acta Soc. Bot. Polon. 1960 : **29** : 289–313.

Details of selfings and crosses in various varieties are presented, on the basis of which it is concluded that: (*a*) pollen reaction is sporophytically determined; (*b*) more than one multiallelic incompatibility locus is involved; and (*c*) pseudocompatibility and cryptic self incompatibility are determined by the action of various alleles at the incompatibility loci.

2662 PETERSON, J. L. & POUND, G. S.
Studies on resistance in radish to *Fusarium oxysporum* f. *conglutinans*.
Phytopathology 1960 : **50** : 807–16.

Penetration and vascular invasion by *F. oxysporum* f. *conglutinans* race 2 occurred in both the susceptible variety Early Scarlet Globe and the resistant Red Prince; mycelial concentration however was sparse in the latter, and conidium and chlamydospore formation was observed only in susceptible plants. While the mycelium extended into the leaves and apical meristem of susceptible plants, it was rarely found above the lower hypocotyl region of resistant plants. Resistance is thought to be localized principally in the vascular system and to be protoplasmic rather than morphological. The segregation ratios obtained during inheritance studies indicate that the character is polygenically controlled.

2663 VAŠČENKO, L.
(Jerusalem artichoke in Sahalin).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1959 : No. 8 : 25–26. [Russian].

Mention is made of the local forms Krasnaja [Red] and Belorozovaja [Whitish Pink], which are more productive of green matter and tubers than Belaja Kievskaja [White Kiev]. The tubers of Belorozovaja are compact.

2664 GALAN, C. & FILIPESCU, H.
Contribuţii la studiul unor populaţii de topinambur din R.P.R. **(Contributions to the study of some Jerusalem artichoke populations in the Rumanian People's Republic).**
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 205–14.

A comparative study of four local populations and the German variety Dornburg was made, data being collected on yield of tubers and green matter, seed production and the inulin and protein contents of the tubers. Dornburg and the population from Craiova yielded best; the Bucureşti population had the highest inulin and protein contents but yielded poorly.

2665 KISS, F. & SÁGI, F.
Összehasonlító vizsgálatok különböző hagymafajták termésértékére vonatkozólag. **(Comparative investigations on different onion varieties with reference to productive value).**
KisérlÜgy. Közl. 1959 : **52C** : 41–52.

Data are given on the yields from seed and setts on different soil types, the dry matter content, the loss in weight and specific gravity occurring after six months' storage, the sugar content and the effects of inbreeding and open pollination upon 1000-grain weight, germination percentage, and yield in 17 varieties. Best storage quality and high sugar content were found in Vertus, Makó and Hegykő Local.

2666 DAVIS, E. W.
Use of cytoplasmic male-sterility in making interspecific crosses in Allium.
Science 1960 : **132** : p. 1481.

Eight cytoplasmically male-sterile inbred lines of *A. cepa* were successfully crossed with *A. fistulosum*, using honey bees as pollinators.

2667 PERRON, J. P., JASMIN, J. J. & LAFRANCE, J.
Attractiveness of some onion varieties grown in muck soil to oviposition by the onion maggot (*Hylemya antiqua* (Meig.)) (Anthomyiidae : Diptera).
Canad. Ent. 1960 : **92** : 765–67.

Field and greenhouse tests showed that *Allium fistulosum* 'Nebuka' and 'Hishiko' were less attractive to ovipositing flies than *A. cepa* 'White Portugal', 'Red Wethersfield', 'Autumn Spice' and 'Early Yellow Globe'; Beltsville Bunching, a hybrid between the two species, was intermediate in attractiveness, particularly in the greenhouse tests. A consistent and significant positive correlation between plant mortality and egg population was observed. When the flies were confined in cages with individual varieties, no intervarietal differences in plant mortality occurred, indicating that under field conditions such differences are due to preferential oviposition on certain varieties.

2668 ZIMINA, T. A. & KRJUKOVA, T. N.
(The wild onions of Sahalin and the prospects of introducing them into cultivation).
Bot. Ž. (Bot. J.), Moskva 1960 : **45** : 844–61.

Descriptions are presented of several forms of *Allium schoenoprasum*, *A. lineare* and *A. victorialis*. Some of those belonging to *A. schoenoprasum* form leaves early and are considered promising both for immediate cultivation and for use as breeding material. A wide range of ecotypes exists.

2669 RUSCONI-CAMERINI, G.
Determinazione del numero cromosomico di *Allium suaveolens* Jacq. **(Determination of the chromosome number of *A. suaveolens* Jacq.).**
Nuovo G. bot. ital. 1959 : **36** : 339–40.

A sample from Alberoni, near Venice, had $2n = 16$ chromosomes.

2670 MEDINA B., J.
Efecto de variedades y selección de semilla en el rendimiento de ajo. **(Effect of varieties and seed selection on the yield of garlic).**
Agric. téc. Méx. 1960 : No. 10 : 13–15.

Trials at Cortazar, Guanajuato State, showed that Chilean was superior to other varieties in yielding ability. The earliest-maturing variety was Japanese, Chilean being intermediate as regards maturity date.

2671 THUESEN, A.
Cytogenetical studies in *Asparagus officinalis* L.
K. VetHøjsk. Aarsskr. 1960 : 47–71.

Both male and female plants had $2n = 20$, with 12 large chromosomes, mostly with secondary constrictions or satellites, and eight small chromosomes with primary constrictions only. Chromosome pair V was heteromorphic in male plants, one chromosome having a median and the other a submedian constriction, while in female plants both chromosomes had median constrictions. Cytological determination of sex prior to flowering on the basis of the above results has proved correct in eight out of nine plants tested so far.

C_0 tetraploid females had the genotype *mmmm* while males had *MMmm*. In the C_1 the expected ratio of 5 males (*MMmm* and *Mmmm*) to one female (*mmmm*) was obtained, but the two male types could not be distinguished morphologically. Tetraploid males and the subandrecious types found among them should be useful in breeding male plants, a higher production of marketable shoots being given by males than females. Diagrams of root-tip mitoses in tetraploid and triploid males are provided. One tetraploid has been cytologically identified as a probable simplex male.

2672 SCHEER, D. F.
Seedling selection of high yielding asparagus plants.
Diss. Abstr. 1960 : **20** : LC Card Mic 60–1451 : p. 4236. (Abst.).

In ♀ plants, a correlation was found between first-year yield and stalk number x diameter of the largest stalk per plant at the age of 2½ months.

2673 KISS, F.
Adatok a káposztafélék virágzásbiológiai vizsgálataihoz. (**Contributions to the study of floral biology in Brassica crops**).
KisérlÜgy. Közl. 1959 : **52C** : No. 2 : 29–37.

Differences in number of stamens and petals and in the height of the anthers in relation to the stigma have been found within and between eight strains of winter cabbage, one of cauliflower and one of kohl rabi. There were indications that the effectiveness of spontaneous or artificial pollination in bagged flowers was favoured by (*a*) a relatively high proportion of flowers with stamens shorter than the stigma and (*b*) calm, sunny weather during pollination. Spontaneous selfing was generally more effective than artificial. The I_2 from the line showing the highest degree of selfing displayed some inbreeding depression but contained a number of vigorous plants.

2674 CONEV, D. T.
(Nitrogenous substances in different botanical varieties of cabbage).
Naučn. Trud. selskostopan. Akad. Georgi Dimitrov. Agron. Fak. (Sci. Trans. G. Dimitrov Agric. Acad. Agron. Fac.) 1958 : **5** : 161–75. [Bulgarian].

Data on the contents of total N, protein N, the α-amino N of free aminoacids, amide N and ammonium N are given for varieties of cabbage, cauliflower, Savoy cabbage, red cabbage and Brussels sprouts.

2675 OLSSON, G.
Species crosses within the genus *Brassica*. II. Artificial *Brassica napus* L.
Hereditas, Lund 1960 : **46** : 351–86.

Artificial *B. napus* was synthesized from crosses between *B. campestris* and *B. oleracea*. Crosses were made at $2x$ and $4x$ levels, and both the subspecies *oleifera* and *rapifera* were obtained. The artificially synthesized material was either morphologically indistinguishable from natural material or differed only slightly. Much of the new material was completely fertile and in those cases where fertility was reduced, selection for a few generations resulted in fully fertile strains. The synthesized rapes and swedes were mostly inferior to the best market varieties in yields of oil and roots respectively, but, by simple selection in the rape material, lines were obtained which outyielded Matador by 7%. Among the swedes, hybrids between artificial and natural varieties gave yields comparable with those of the high-yielding variety Fenix-Bangholm. Preliminary studies have shown that meiosis in the fully-fertile A_1 plants is much more regular than was the case in artificial *B. juncea* material [cf. XXX, 4196]. The use of the synthesized forms as breeding material is discussed; valuable characters found in the rape material include increased resistance to *Peronospora* and improved winter hardiness.

2676 NIEUWHOF, M. & KRAAI, A.
Praktijkproeven met rode kool 1956–1958. (**Commercial trials of red cabbage, 1956–1958**).
Meded. Dir. Tuinb. 1960 : **23** : 453–58.

Data on the uniformity, earliness, quality and productivity of strains of Zenith and the

Langendijk strains Vroege Rode [Early Red], Herfstrode [Autumn Red] and Bewaar-rode [Keeping Red], tested in the Netherlands, are presented.

2677 Bunescu, D., Tălpălaru, G., Iordăchescu, C. & Schneider, I.
Linii noi de varză albă timpurie, semitimpurie şi tîrzie. (**New early, semi-early and late varieties of cabbage**).
Grădina Via Livada 1960 : No. 5 : p. 6. (Abst.).

In breeding work at the Ţigăneşti research station, 7 new early lines, 9 semiearly lines and 29 late lines have been obtained. The best have outyielded local standards.

2678 Honma, S. & Heeckt, O.
Results of crossing *Brassica pekinensis* (Lour.) Rupr. with *B. oleracea* L. var. *acephala* DC.
Euphytica, Wageningen 1960 : **9** : 243–46.

In studies conducted at Michigan Agricultural Experiment Station, F_1 plants from the above cross, obtained through the use of Chinese cabbage as seed parent and the application of the growth regulator N-m-tolylphthalamic acid to the flowers, were vegetatively intermediate between the parents but resembled kale in inflorescence type, at the same time showing cyclic sterility like that of Chinese cabbage. Back crosses of the F_1 to *B. pekinensis* as either seed or pollen parent were readily effected, but back crosses to kale were not attempted. The F_2 showed continuous variation for the characters studied.

2679 Rundfeldt, H.
Untersuchungen zur Züchtung des Kopfkohls (*B. oleracea* L. var. *capitata*). I. Untersuchungen zur Verbesserung der Züchtungsmethodik auf der Basis der entwicklungsphysiologischen und blütenbiologischen Besonderheiten des Kohls. [**Investigations on the breeding of cabbage (*B. oleracea* L. var. *capitata*). I. Investigations on the improvement of breeding methods on the basis of the peculiarities of the developmental physiology and floral biology of the cabbage**].
Z. Pflanzenz. 1960 : **44** : 30–62.

The results of vernalization experiments are described. Cabbages may be either biennial types, which only flower after experiencing a cold period, or winter annuals, which do not need a cold period for the induction of flowering although flowering is accelerated by low-temperature treatment. Cabbage may be propagated by shoot, leaf and root cuttings, propagation being easiest using leaf cuttings with an attached bud and piece of stem. Amongst some varieties, 40–50% of the plants are self sterile. This sterility is sporophytically inherited and can be overcome by hand pollination of the buds; a suitable procedure is described for artificial self and cross pollination. In crossing experiments, it was found that the quantity of seed set varied with the parent varieties. Mass and single-plant selection are described; an improved procedure for individual selection involves vegetative propagation of the mother plants.

The production of synthetic varieties does not differ greatly from the process described for single-plant selection and the heterosis method is preferred. Three ways of breeding hybrids are described; they depend respectively on the use of marker genes recognizable in early development, a pollen sterility factor labile in different environments and inherited self sterility. The third mentioned method appears to be the most convenient.

2680 Nieuwhof, M.
Internal tipburn in white cabbage. I. Variety trials.
Euphytica, Wageningen 1960 : **9** : 203–08.

In 1952 and 1953 clear differences in incidence of tipburn were found among strains and varieties tested. In 1955, among 36 strains of different varieties, one strain each of Succes, Brunner Diamant [Brunn Diamond], Glückstädter Dauer Weisskohl [Glückstädt Keeping cabbage] and Wädenswiller Einschneide [Wädenswil Preserve] was free from tipburn. The disorder seems to be more frequent in rapidly growing varieties.

2681 Jemmett, J. L. & Finch, C. G.
Autumn cauliflower trials 1954–56.
J. nat. Inst. agric. Bot. 1959 : **8** : 651–66.

Information is provided on the cropping capacity, time of heading, head quality and other aspects of the performance of 19 varieties, as observed in trials in England.

2682 Haine, K. E.
Time of heading and quality of curd in winter cauliflower.
J. nat. Inst. agric. Bot. 1959 : **8** : 667–74.

A period below 60° F. is required for curd initiation, this period being longer for late than for early varieties. Kept continuously above 60° F., the plants remain vegetative. The time required under cool conditions is cumulative, but fluctuating temperatures tend to lead to the production of "bracted" heads. The breeder may be able to develop stocks with more uniform cropping periods and less bracting with the aid of techniques based on these results.

2683 Winterdijk, P. J.
Selectie van spruitkool. (**Selection of Brussels sprouts**).
Tuinbouwber., Groningen 1960 : **15** : p. 187.

The seed obtained on selfing three plants was small in amount but viable and yielded three progenies differing from each other but each highly uniform in plant height, sprout setting and earliness. Selections from the two best progenies were selfed but set even less seed than the original selfed plants had done.

2684 Johnson, A. G.
New breeding methods for Brussels sprouts.
Worcs. agric. Chron. 1960 : **27** : 159–71.

[Cf. XXX, 3270].

2685 Borchers, E. A.
The development of F_1 spinach hybrids adapted to eastern Virginia.
Virginia J. Sci. 1959 : **10** : p. 237. (Abst.).

Many experimental F_1 hybrids have produced appreciably higher yields than standard commercial varieties, but in most cases have shown commercially undesirable characters. Preliminary work has however indicated the possibility of developing disease-resistant hybrids which will be acceptable.

2686 Janick, J. & Bose, S.
Heteromorphism involving the "sex chromosomes" of *Spinacia oleracea.*
Genetics 1960 : **45** : p. 994. (Abst.).

The chromosome–I pair is commonly isomorphic but cases of heteromorphism, in which the nonstandard member was associated with the Y factor, have been reported. Standard chromosome I is heterobrachial with one arm about twice as long as the other. The authors have examined a number of introductions cytologically. Fourteen out of 36 plants in one line (PI169671) from Turkey have shown heteromorphism for chromosome I, one member of the pair being considerably longer than the standard. The longer chromosome was isobrachial, the added length apparently being due to an additional segment on the short arm. When induced to flower, this line segregated into 17 pistillate and 19 monecious plants; no staminate plants appeared. Of the 14 heteromorphic plants, 6 were pistillate and 8 monecious. By selfing a monecious heteromorphic plant, an individual homozygous for the larger chromosome I has been obtained.

2687 Sutô, T. & Sugiyama, S.
Sex expression and determination in spinach. I. Growth habit and its sex-limited inheritance.
Japan. J. Bot. 1960 : **17** : 163–76.

From a comparison of ten growth characters, plants of a Japanese prickly spinach population were classified into bracted male (B♂), leafy male (L♂) and female (♀). Occasional bisexual plants occurred in L♂ and ♀ but never in B♂. The B♂ form is considered to be the primitive male form. Male progenies from females pollinated by B♂ or L♂ always resembled the pollen parent. To explain this sex-linked inheritance, two kinds of Y chromosomes are postulated, Y^B carrying a strong male factor conditioning the B♂ growth pattern and Y^L carrying a weak male factor conditioning the L♂ pattern.

2688 Willems, F.
Rassenproef op vroege kropsla. (**Varietal trial of early cabbage lettuce**).
Tuinbouwber., Leuven 1960 : **24** : 198–99.

Among 25 varieties and strains tested in the cool greenhouse in trials held in the province of Antwerp, Belgium, strain 2 (Interrex x Regina) was of particular interest in being a week earlier than Meikoningin [May Queen] and equal to the latter in quality. Strain 2 was also among the earliest varieties when planted out of doors. Among varieties sown in the open, 125/58 (Attractie [Attraction] x Vroege van Heverlee [Heverlee Early]) gave exceptionally large heads with smooth firm leaves.

2689 Lindqvist, K.
On the origin of cultivated lettuce.
Hereditas, Lund 1960 : **46** : 319–50.

The *serriola* group of *Lactuca* was studied with special reference to characters separating *L. serriola* from *L. sativa* and to primitive forms of the latter species [cf. 2690]. To explain the close relationship between the two species, a theory of hybridization and evolution along the lines suggested by Anderson [cf. XIX, p. 916] is preferred to the generally accepted theory of direct descent of *L. sativa* from *L. serriola.* Evidence of occasional spontaneous hybridization between the two species is given; if such hybridization results in introgression of genes potentially useful to the wild species, hybrid derivatives with a selective advantage will occur and will gradually oust other forms. In this way a close relationship between the weed and the cultivated species will be maintained.

Natural selection will reduce the visible effect of hybridization in the wild species and maintain the morphological differentiation.

2690 LINDQVIST, K.
Inheritance studies in lettuce.
Hereditas, Lund 1960 : **46** : 387–470.

In a previous paper [cf. XXX, 4377] it was shown that *Lactuca sativa* and the wild species *L. serriola* belong to the same ecospecies. The lines used in this study originated from these two species and from segregates from various crosses within and between them.

Two new anthocyanin genes, *I* and *V*, were identified [cf. XXIX, 2016]; the recessive *i* intensifies while the recessive *v* reduces anthocyanin pigmentation. In *vv* plants the colour produced by *C* and *T* gradually vanishes as the plants develop. The intensified pigmentation of plants homozygous for the recessive gene *i* disappears in plants homozygous for *v*. A new allele of the *R* series, designated *r*, was found which produces a brownish-red colour at the tips of young seed stalks and side shoots; the colour is similar to that of the "red" type but weaker. The new allele is recessive to *R* but dominant ro *r′* and *r*.

Two leaf-colour genes were identified and assumed to be identical with genes *G* and *Lg* reported in early work by Bremer and Thompson respectively. *Lg* and *G* are located on the same chromosome. Some disturbed segregation ratios were associated with a pollen lethality factor which is linked with the *G* locus. A spontaneous mutation from *G* to *g* is reported in the variety Cheshunt Early Giant.

An allele causing abnormalities at gametogenesis and fertilization and disturbing the ratios in progenies segregating for leaf form (conditioned by a series of alleles at the *U* locus [cf. XXIX, 2016]) has been designated *ga*. The size of the deviation from the normal monohybrid ratio in segregating families depends partly on the proportions of *Ga* and *ga* gametes which accomplish fertilization, and partly on the amount of crossing over between *Ga* and *U*. The possibility of more than one allele at the *Ga* locus or of more than one gametophyte locus is considered.

The genes for acute and blunt apex have been designated *P* and *p* respectively; *P* is incompletely dominant.

Plants with normal venation have appeared in most generations of a striate-veined line of Tezier during 1952–58 despite continued selection for the striate character. It is assumed that the recessive gene *st* has a tendency to mutate to the dominant allele and that this tendency is genetically controlled; a single dominant mutability gene is postulated. Off-types with oblong spatulate leaves have also appeared repeatedly in this variety; they do not form hearts but have a growth habit similar to that of a self-folding Cos lettuce. Attempts to cross this type with typical Tezier plants have so far been unsuccessful and it is not known whether the growth habit is due to mutation of a recessive hearting gene. Mutation from *st* to *St* also occurs in the off-type, resulting in a Cos lettuce with normal venation.

A recessive gene *gl* was responsible for the almost complete absence of wax in Altaica. It was not possible from the data available to determine whether variation between forms other than Altaica was due to different alleles at the *Gl* locus, to modifying genes or to both.

The designation *L* is used for Bremer's photoperiodism gene *T* to avoid confusion with the anthocyanin gene. The data indicate that various lines of *L. serriola* and the primitive forms of *L. sativa* all have the dominant allele *L*, while the recessive *l* for insensitivity to photoperiod occurs only in cultivated lettuce. This is contrary to Bremer and Grana's view [VI, 291] that the dominant gene for long-day reaction originated during domestication; it appears more likely that mutation since cultivation has been to the recessive allele.

Hearting was found to be conditioned by three major genes, *K*, *H* and *Ca*, and a number of modifiers. *H* is linked with the yellow-colour gene *g*. The self-folding habit of Cos lettuces appears to be due to recessive genes, or possibly one recessive gene, not identical with *k* or *h*.

The designation *Sp* is used for Durst's prickly-leaf gene *S* [cf. I, 428]. Evidence was found for the existence of an allelic series *Sp*, sp_2, sp_1, *sp*.

Three recessive complementary genes for male sterility designated ms_1, ms_2 and ms_3 were identified. Preliminary observations on affected plants show that very few PMCs are formed, and that meiosis in these is characterized by a high degree of asyndesis.

Studies confirmed the presence of two genes, *W* and *Y*, for seed colour.

The two linkage groups found, *Lg–G–H–I* and *V–U*, are discussed. Abnormal segregation ratios associated with partial pollen sterility were found for the genes of the first group, and an hypothesis involving three complementary factors, X_1, X_2 and X_3, is proposed. Aberrant ratios at the *U* and *V* loci associated with a gametophyte factor may also involve complementary genes. Evidence of linkage between *C* and *R* reported by Thompson [cf. IX, 524] was not supported by the present data. Present knowledge of the distribution of alleles at 19 different loci in *L. serriola* and in the various forms of *L. sativa* is summarized in tabular form.

2691 Verhoeff, K.
On the parasitism of *Bremia lactucae* Regel on lettuce.
Tijdschr. PlZiekt. 1960 : **66** : 133–40.

It is noted that no physiological differentiation was detected among samples of *B. lactucae* collected from cabbage lettuces at 15 different localities in the Netherlands. The 133 cabbage lettuces tested were susceptible, but no fructifications were formed on *Lactuca serriola, L. saligna, L. sativa* var. *longifolia* 'Grand Rapids', *L. sativa* var. *crispa* 'Jade' and 'Imperial' or a number of North American lettuce varieties.

2692 Plumier, W.
Biologie florale et fécondation de la chicorée-Witloof. (**Floral biology and fertilization in Witloof chicory**).
Rev. Agric., Brux. 1960 : **13** : 780–86.

The various stages in flowering and fertilization of Witloof chicory are described. Under conditions when cross fertilization was prevented, evidence was obtained of the occurrence of apogamy in the species.

2693 Dutta, S. K. & Garber, E. D.
Heterokaryosis in *Colletotrichum lagenarium.*
Genetics 1960 : **45** : p. 985. (Abst.).

Colour and biochemical mutants of *C. lagenarium* (*Glomerella lagenaria*) were isolated after spores of two physiologic races had been exposed to ultraviolet rays. Heterocaryons involving nutritionally deficient mutants of the same race or different ones were readily produced and displayed characteristic colour and morphology, depending upon the component strains.

2694 Nieto H., V.
Observaciones sobre adaptación de variedades de melón en el Valle del Yaqui. (**Observations on the adaptation of melon varieties in the Yaqui valley**).
Agric. téc. Méx. 1960 : No. 10 : 19–20.

Data are provided on the performance of 12 varieties in a 1959 trial at Cd. Obregón, Sonora. The outstanding varieties were Edisto and Honeyball Oro Blanco [Honeyball Golden White].

2695 Galka, A. T.
(**Bush types of melon and pumpkin**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1959 : No. 8 : 146–49. [Russian].

The techniques employed for breeding melons and pumpkins with a bush habit at Dnepropetrovsk are described. The following methods have been developed in recent years for the production of hybrids which segregate bush types in the F_1. (1) An ordinary variety is grafted on a bush type and the scion flowers are fertilized with pollen from the stock. (2) A variety is pollinated with mixed pollen of two others, the mother variety or one of the pollen parents being a bush type. Promising hybrids have been obtained and are now under observation.

2696 Thakare, R. G. & Bora, K. C.
Influence of neutron radiation on sex-ratio in *Citrullus vulgaris* (watermelon).
Curr. Sci. 1960 : **29** : 322–23.

Neutron irradiation of the Midget and Asahiyamato [Japanese Rising Sun] varieties of water melon led to a significant increase in the frequency of female flowers, without affecting male flower frequency substantially. The effect, which is similar to that caused by certain chemicals, appears to be physiological in nature. It is suggested that potential sporogenous cells were affected by the treatment during the initial stages of their development.

2697 Shimotsuma, M.
Cytogenetical studies in the genus *Citrullus*, II. Intra- and inter-specific hybrids obtained from all possible cross-combinations between diploid and tetraploid *C. colocynthis* Schrad. and *C. vulgaris* Schrad.
Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 37–48.

Crosses involving all combinations of 2*x* and 4*x* *C. colocynthis* and 2*x* and 4*x* *C. vulgaris* 'Asahiyamato' [Japanese Rising Sun] were attempted.

All combinations gave viable seed except crosses of the type 4*x* ♀ x 2*x* ♂. The characters of *C. colocynthis*, in particular pigmentation of the fruit and bitterness, tended to be dominant in interspecific crosses [cf. XXX, 2031].

2698 Spurr, A. R. & Davis, G. N.
New watermelon Klondike RS–57 for long-distance shipping.
Calif. Agric. 1960 : **14** : No. 6 : p. 5.

Klondike RS–57 (Blue Ribbon x Ironsides) combines tough rind with high flesh quality.

2699 Ivanoff, S. S.
Station releases new watermelon.
Miss. Fm. Res. 1960 : **23** : No. 11 : 1, 6.

Shipper, which was selected at the Mississippi Agricultural Experiment Station after a series of crosses involving Dixie Queen, Klondike R7, Leesburg and Blacklee, is expected to fill the need for a "round, dark green, high-quality melon of the shipping type with desirable flesh and rind and with consumer appeal". The variety is highly resistant to *Fusarium* wilt. Its yielding ability is similar to that of other prolific varieties. As regards maturity, Shipper is as early as Black Diamond and Charleston Gray and is sometimes earlier.

2700 VIDVEI, E.
Forsøk med frilandsagurker 1958. **(Trials of outdoor gherkins, 1958).**
Stensiltrykk Inst. Grønsakdyrk. 1959 : No. 5 : 10–23.

Details of yield, fruit size and quality are presented for 18 varieties tested at Ås, Norway.

2701 POPA, D.
Soiuri de castraveţi indicate pentru culturile din sere şi răsadniţe. **(Cucumber varieties recommended for cultivation in greenhouses and hotbeds).**
Grădina Via Livada 1960 : No. **5** : p. 6. (Abst.).

Varietal recommendations for Rumania are made as a result of trials already mentioned and of investigations in 1959 [cf. XXX, 4385].

2702 BOWERS, J. L.
Cucumbers grown for pickling.
Arkans. Fm. Res. 1960 : **9** : No. 5 : p. 11.

The cucumber-breeding programme at Hope and Fayetteville, Arkansas, is described briefly. Progress has been made in the development of lines suitable for pickling and possessing the cluster-bearing habit, i.e. several fruits at one node. An attempt is now being made to incorporate anthracnose resistance in the improved lines.

2703 SEMENKO, A. M.
(The improvement of the cucumber variety Murom).
Agrobiologija (Agrobiology) 1959 : No. **4** : 519–26. [Russian].

Single plant selection, continuous mass selection and intravarietal hybridization between forms grown in different environments or in different years improved the earliness, quality and yield of the above variety in experiments at Murom and Gribovo.

2704 AXELSSON, F.
Arla, W : s original F_1-drivgurka. **(The original Weibull F_1 forcing cucumber Arla).**
Agri hort. genet., Landskrona 1960 : **18** : 234–40.

Tabulated results of trials involving the early, productive, high-quality hybrid Arla are presented. This greenhouse cucumber has already been described [XXIX, 789].

2705 AXELSSON, F.
Fakta rörande drivgurkan Arla. **(Facts about the forcing cucumber Arla).**
Weibulls Allehanda 1960 : **20** : 3–7.

Data are presented showing the superiority of Arla in early and total yield in trials during 1955–60 [cf. XXIX, 789].

2706 PETERSON, C. E.
A gynoecious inbred line of cucumber.
Quart. Bull. Mich. agric. Exp. Sta. 1960 : **43** : 40–42.

MSU713–5, which is homozygous for gynecious sex expression, was developed by crossing a gynecious segregate found in the Korean variety Shogoin with the pickling variety Wisconsin SMR18. The plants are uniform and vigorous, producing two to four strong lateral branches, while the fruit is black spined and of the pickling type. The new line has shown some tolerance of mosaic and is resistant to scab. A number of hybrids have been produced using MSU713–5 and are now undergoing commercial trials. A study of flower production in the hybrid MSU713–5 x MSU238 indicated the necessity of providing a supplementary source of pollen for such hybrids, in order to ensure sufficient for fruit production in the field.

It is stated that homozygous gynecious lines and gynecious F_1 hybrids of any type of cucumber may now be produced. Gynecious sex expression may also be introduced into certain parthenocarpic European greenhouse varieties to eliminate the problem of unwanted pollination.

Bericht über die 3. internationale Gartenbaukonferenz der Mitgliederstaaten des Rates der gegenseitigen Wirtschaftshilfe vom 7. bis 15. September 1959 in Budapest. **(A report on the 3rd International Horticultural Conference of the Member States of the Council for Mutual Economic Aid from 7 to 15 September 1959 in Budapest).**
Dtsch. Gartenbau 1960 : **7** : No. 5 : Suppl. : Pp. 12.

2707 *Fabig, F. Die Gemüsezüchtung in der Volksrepublik Ungarn.* (*Vegetable breeding in the Hungarian People's Republic*). (*pp.* 5–6).

Special mention is made of tomato breeding. Of the new varieties, Kecskemét 363 has proved particularly good for the production of purée and gives good yields in dry sandy soil. Tetraploids of Kecskemét 42 and Kecskemeter Zwerg [Kecskemét Dwarf] produce purée of better colour than the diploids. However the tetraploids produce less fruit and seed, ripen later and are less resistant to drought. Kecskemeter Zwerg and Budaier Frühe [Buda Early] are early varieties with good transporting quality. The bush hybrid Kecskemét 42 x 1/1 ripens earlier than the Bulgarian standard variety 10 x Bison. The early line 1/1 came from the cross Kecskemét 30 x *Lycopersicon pimpinellifolium*. Breeding for disease resistance is being carried out using wild species.

Hybrid sweet peppers of improved quality and disease resistance are also being developed.

2708 Persson, A. R.
En ny verdifull serie tomathybrider for veksthus? **(A new, valuable series of tomato hybrids for the greenhouse ?)**
Gartneryrket 1959 : No. 4 : Pp. 4.

Details of early and total yields, quality, fruit size and resistance to *Cladosporium fulvum* are given for 12 Scandinavian varieties and F_1 hybrids tested in Norway in 1958. The Danish hybrids Atocross, Danimuna and Earlymuna C were promising.

2709 Popa, D.
Soiuri de tomate indicate pentru cultura forţată în răsadniţă. **(Tomato varieties recommended for forcing in hotbeds).**
Grădina Via Livada 1960 : No. 5 : p. 7. (Abst.).

The Rumanian trials previously reported have been continued for another year [cf. XXX, 4393].

2710 Babb, M. F.
Performance of 58 tomato varieties under greenhouse culture in Alaska, 1949–1958.
Bull. Alaska agric. Exp. Sta. 1959 : No. 28 : Pp. 15.

A report is given on the performance of varieties and hybrids tested at the Alaska Agricultural Experiment Station. Information on reactions to *Cladosporium fulvum* is included.

2711 Daskalov, A. H., Jordanov, M. & Popova, D.
(A study of tomato varieties for the processing industry).
Izv. central. naučnoizsled. Inst. Rasten. (News central sci.-res. Inst. Pl.-Industr.), Sofija 1960 : **9** : 5–15. [Bulgarian].

As a result of tests conducted during 1956–59, the heterotic hybrids Rudgers* x Zarja [Dawn] and Kecskemét x Rudgers and the variety Kecskemét 363 are recommended for cultivation; they ripen early, yield well and are superior to Rudgers and Plovdiv 14 in contents of dry matter, sugar and vitamin C.

2712 Clayberg, C. D., Butler, L., Rick, C. M. & Young, P. A.
Second list of known genes in the tomato.
J. Hered. 1960 : **51** : 167–74.

Additional rules of nomenclature drawn up by the Tomato Genetics Cooperative of the USA are presented. A further 175 gene symbols, and the corresponding main phenotypic characters, synonyms and appropriate references, are listed [cf. XXV, 3497].

2713 Williams, W.
Relative variability of inbred lines and F_1 hybrids in *Lycopersicum esculentum*.
Genetics 1960 : **45** : 1457–65.

"(1) The relative level of nongenetic variability in respect of five quantitative characters has been compared in six F_1 hybrids and eight inbred lines of the tomato.

"(2) Both the inter- and intrapopulation level of variability of the F_1 hybrids fell within the range of their respective parents. None of the data suggests any intrinsic difference between inbred lines and hybrids in respect of their ability to buffer or to eliminate the variability that is induced by the environment.

"(3) In four out of eight instances, the level of variability for certain characters was shown to be correlated with the magnitude of the mean. In two cases where there was significant correlation between the mean and the standard deviation, the differences in variability could not be entirely explained by differences in the means, and in these, different homozygous genotypes conditioned different levels of variability irrespective of the size of the mean.

"(4) The characteristic levels of variability of certain parents were found to be transmitted to the F_1 hybrids. Generally, the variability of F_1 hybrids fluctuated around the mid parental value, but in respect of flowering date low variability was transmitted as a dominant character.

"(5) These findings are briefly discussed in relation to the known variability patterns of outbreeding species, and possible reasons for

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* ? Rutgers.

differences in variability patterns resulting from the two breeding systems are suggested."
[Author's summary].

2714 BRABEC, F.
Über eine Mesochimäre aus *Solanum nigrum* L. und *Lycopersicon pimpinellifolium* Mill. **(A mesochimera from *S. nigrum* L. and *L. pimpinellifolium* Mill.).**
Planta 1960 : **55** : 687–707.

The chimera described has a single-layered mesosoma of *L. pimpinellifolium*; possible changes of the chimera into other forms are discussed.

2715 TOMES, M. L., STEVENSON, E. C., JOHNSON, K. W., WILCOX, G. E. & KLINKER, W. J.
The derivation, culture, and utilization of Epoch, a dwarf tomato variety.
Res. Bull. Purdue Univ. 1960 : No. 701 : Pp. 7.

[Cf. XXXI, 1036].

2716 BOARD, P. W.
Evaluating tomato varieties for processing.
Tech. Pap. Commonw. Sci. Industr. Res. Org. Aust. 1960 : No. 17 : Pp. 11.

A description is given of field design and sampling procedures suitable for the evaluation of tomatoes for processing in terms of yield, chemical composition and organoleptic qualities. The results obtained by application of these procedures to four trials involving nine introduced and domestic varieties are reported. The American variety Urbana was superior to all others in yield and solids content. All samples proved to be acceptable as regards quality, with Urbana and Grosse Lisse [Large Smooth] being consistently ranked highly.

2717 POPMARINOV, P., FIKIIN, A. & JORDANOV, M.
(Study of the suitability of some tomato varieties for freezing).
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 101–11. [Bulgarian].

Data on the contents of dry matter, sugars, acids and vitamin C are given for 12 varieties and hybrids. Changes in composition were generally slight after six or seven months' storage in the frozen state. The varieties most suitable for freezing were those with the best biochemical composition, viz. 24, Heterosisna konserva [Heterotic Preserving], Plovdivska konserva [Plovdiv Preserving], 10 x Plovdivska konserva and 10. The heterotic hybrid 10 x Rudgers*, which has characteristics valuable to the grower, was also suitable.

2718 YOUNG, H. W.
Inheritance of radial fruit cracking in a tomato cross.
Proc. Fla. hort. Soc. 1959 : **72** : 207–10.

Radial cracking was determined by two pairs of major genes (*crcr* and *rlrl*) in a cross between Alabama 10–1 (resistant) and Marglobe (susceptible). Resistance to cracking was recessive and associated with pink fruit colour, high number of fruits per plant, low number of locules per fruit, small fruit diameter and determinate habit.

2719 PRASHAR, D. P.
Inheritance of fruit cracking in tomatoes.
Diss. Abstr. 1960 : **21** : LC Card Mic 60–2098 : p. 4. (Abst.).

An analysis was made of crosses involving Glamour and NY55–542, which are resistant to radial cracking, and the susceptible varieties Marglobe and Mosage. Cracking was incompletely dominant and depended on several major and minor genes with dissimilar effects. Thus resistance may be increased by crossing two resistant parents or by crossing a resistant with a susceptible variety.

Growers Handbook and 45th Annual Proceedings of the Ohio Vegetable and Potato Growers Association 1960 : Pp. 95.

2720 *Hafen, L. Bibb lettuce and leaf mould resistant tomato studies. (pp. 54–57).*

A brief account is given of a breeding programme at Purdue University designed to incorporate immunity to leaf mould, *Cladosporium fulvum*, and *Fusarium* wilt in commercial varieties of tomato. Amongst the plants being used are leaf-mould immune lines of *Lycopersicon hirsutum* and *L. pimpinellifolium*.

2721 MILINKÓ, I.
Dohánymozaik—vírus ellenállóságra—nemesítés kilátásai paradicsomnál. **(Prospects in breeding for resistance to tobacco mosaic virus in tomato).**
KísérlÜgy. Közl. 1958 : **51C** : 85–93.

In studies carried out in 1954 and 1955 at the Kecskemét Agricultural Experimental Institute, Hungary, healthy material found among infected tomato plants proved neither resistant nor hypersensitive on being artificially inoculated. From 1957 onwards, seedling inoculation tests of hybrids of *Lycopersicon esculentum* with *L. pimpinellifolium*, *L. racemigerum* and *L. hirsutum* and of species and varieties obtained from abroad have been effected. Two cultivated varieties were tolerant and gave rise to resistant forms, which have been crossed with *L. hirsutum* to give five resistant plants; these are expected to be useful parents. A reliable method of testing has been devised, which involves taking young shoots from plants showing no symptoms after inoculation, placing them in a nutrient solution and reinfecting them; resistant cuttings which develop roots can then be cultivated as clones.

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* ? Rutgers.

2722 **Develop new eggplant variety.**
Mon. Bull. UP Coll. Agric., Los Baños 1960 : **25** : No. **4** : 1–2.

Resistant to bacterial wilt, Clustered was developed at the Central Experiment Station, University of the Philippines, from (Native Long Purple x the American variety Rosita) x Indian. Bearing heavy clusters of fruit, it surpasses Native Long Purple in both quality and yield.

2723 Popova, D.
[**Studies of the influence of the amount of pollen in pollination and fertilization of the egg plant (*Solanum melongena* L.)**].
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1959 : **7** : 163–73. [Bulgarian].

The following observations have been made at the Vrana Plant Breeding Institute, Bulgaria. Pollination with a large quantity of pollen (*a*) increases the percentage fruit set, (*b*) decreases the percentage of parthenocarpy and (*c*) increases the average number of seeds per fruit. A mixture of pollen from numerous species has the effects (*a*) and (*c*), and also increases the viability of the progeny. Several pollinations result in a lower percentage of parthenocarpy than a single pollination with a large amount of pollen.

2724 Winstead, N. N. & Kelman, A.
Resistance to bacterial wilt in eggplant in North Carolina.
Plant Dis. Reptr. 1960 : **44** : 432–34.

Greenhouse and field tests showed Matale and Kopek to be highly resistant to *Pseudomonas solanacearum*. Florida Market, Florida High Bush and Fort Myers Market were intermediate in resistance while Black Beauty and New York Spineless were susceptible. While the undesirable fruit colour and shape of Matale and Kopek may limit their use commercially, they should prove useful as breeding material.

2725 Vasiliu, N.
Cercetări asupra germinaţiei seminţelor de mazăre, soia, fasole şi năut, în condiţii de laborator şi cîmp. (**Researches on the germination of the seeds of pea, soya bean, French bean and chickpea under laboratory and field conditions**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 73–84.

Data are provided on the germination energy and germinability of 3 varieties of pea, 3 of soya bean, 3 of French bean and 1 of chickpea.

2726 Holden, J. H. W. & Bond, D. A.
Studies on the breeding system of the field bean, *Vicia faba* (L.). 1. Natural cross breeding in *V. faba*.
Heredity 1960 : **15** : 175–92.

"1. Estimates of natural cross fertilisation in winter field beans in 1953 gave values of 29·5 and 34·8 per cent. for Norfolk and Cockle Park material respectively. In 1954 at Cockle Park the estimates were: for winter beans 69·8 per cent., for spring field beans 60·5 per cent. and for broad beans 32·5, 35·1 and 41·2 per cent. cross fertilisation.

"2. Dissection of flowers shows that stigmatic papillæ are ruptured by the tripping process and that pollen is present on the stigma and in the keel for 24 hours before the flower is open and ready for bee visitation.

"3. As the above estimates show, this self-pollination does not lead to complete self-fertilisation. Large increases in seed setting due to self-fertilisation follow tripping. It is inferred that tripping, through the rupture of the stigmatic surface, renders the stigma suitable for pollen germination, and the need for tripping ensures that, with the coincident arrival of foreign pollen, both self and foreign pollen may germinate together.

"4. The frequencies of self- and cross-fertilisation in tripped flowers will depend on the relative growth rates of self and foreign pollen tubes down the style. Experiments failed to reveal any differential growth rates in this material and it is concluded that tripped, i.e. visited flowers, yield equal numbers of selfed and crossed progeny.

"5. Not all population plants need to be tripped in order to set seed. Some have the ability to self-fertilise quite readily when untripped, i.e. are spontaneously self-fertile.
"6. Spontaneous self-fertility is a property of crossbred plants and of certain inbred individuals and lines. It appears to have two causes (i) heterozygosity in population plants, and (ii) specific genes in inbred lines.
"7. It is suggested that the breeding behaviour of a plant depends on its origin. Crossbreds will tend to self through spontaneous self-fertility while inbreds which require to be tripped will yield both inbred and crossbred progeny." [Authors' summary].

2727 Rowlands, D. G.
Fertility studies in the field bean (*Vicia faba* L.). 1. Cross- and self-fertility.
Heredity 1960 : **15** : 161–73.

A maximum flower set of 50% was recorded in open-pollinated material, with a mean of 24%. Selfing the same *V. faba* population in a glasshouse gave only 7·3%, even after tripping the flowers.
A diallel cross involving six parent plants was not effective in demonstrating any overall superiority of crossing over selfing but did show that some parents crossed better than others. Spontaneous self fertility of the progeny from the diallel cross showed large differences between parents, numbers 5 and 6 being highly self sterile. "The *Wr*/*Vr* graphs indicate an interaction, an effect which could be largely removed by scaling. Omission of arrays 5 and 6 gives a further improvement of the slope although the slope still differs from unity. It is inferred from the relative position of the arrays on the graph that the dominant genes confer self-fertility and the recessive genes self-sterility. The data were also consistent with the necessity for tripping being dominant to the ability to set seed without tripping."
A hypothesis is suggested which explains this self sterility in terms of the homozygosity of deleterious recessive genes which can accumulate in any outbreeding system. Breakdown of the original outbreeding system, resulting from migration of the species from its centre of origin as well as by cultivation practices, would be followed by zygotic sterility caused by the deleterious recessive genes. The implications of the proposed hypothesis on the possible development of inbred lines are discussed [cf. XXVIII, 4863].

2728 Sortsforsøg med høje bønner 1955–58.
(Varietal trials of climbing beans, 1955–58).
Tidsskr. Planteavl. 1960 : **64** : 357–60.

Data are given on the performance of ten French bean and three runner-bean varieties tested at two stations in Denmark.

2729 Abrahão, I. O.
Melhoramento do feijoeiro. **(Improvement of the bean).**
Bragantia 1960 : **19** : 129–61.

Trials of numerous local varieties and selections from them and of a few introduced strains at Campinas, São Paulo, are reported. The highest yields were obtained from varieties of the Prêto [Black] and Rosinha [Pink] groups.

2730 Agnew, G. W. J.
French bean variety and spacing trial.
Qd. J. agric. Sci. 1959 : **16** : 283–90.

In trials during 1957 at the Maroochy Experiment Station, Queensland, the new rust-resistant varieties Redlands Belle [Langshaw Beauty (selection of Brown Beauty) x Florida Belle] and Redlands Beauty (Brown Beauty x Californian Small White) [cf. XXX, 210] gave considerably higher yields than the three older commercial varieties tested. Rust was present but was not sufficiently severe to reduce yield in the more susceptible entries. Differences in percentage pod set were obtained for varieties but not for spacings in and between rows. Weight loss in beans packed in wooden cases for a 6-day period of storage was influenced by variety rather than by tightness of the pack, attention being drawn in this connexion to varietal differences in pod shape in cross-section.

2731 Sen, N. K. & Ghosh, A. K.
Genetic studies in green gram.
Indian J. Genet. 1959 : **19** : 210–27.

Data on purple pigmentation in intervarietal crosses in *Phaseolus aureus* are explained by postulating the gene pair Pp and multiple-allelic series $C > c^b > c$. C, together with P, determined purple hypocotyl, epicotyl, stem and petiole. $P + c^bc^b$ resulted in purple hypocotyl, spotted epicotyl, green stem and petioles with several spots. Homozygotes for both p and c^b had spotted hypocotyl, green epicotyl, green stem and petioles with only a few spots. Irrespective of P or p, cc plants lacked purple colour in all parts. The pigment in yellow types of flower was mainly in chromatoplasts. Oil-yellow flower (O) was dominant over palm-leaf yellow (*o*); sulphur-yellow flowers were due to the effect of *cc*. Purple pigmentation of the calyx and standard depended on the genetic system controlling this character in other parts. Seed colour depended upon sap-soluble pigments controlled by two pairs of genes, *Bb* and *Bfbf*, and also upon the shade and number of the chloroplasts, governed by *Gg*. The genotypes *BB BfBf GG*, *bb BfBf GG*, *bb BfBf gg* and *bb bfbf GG* had blue-green mosaic, green, greenish-yellow and buff seed, respectively, *Bb* being responsible for blue *v.* no pigment, *Bfbf* for no pigment *v.* buff and *Gg* for green *v.* greenish yellow. Other genes reported are: the complementary genes *Lp* and *A* for black pods when ripe, *aa* + *Lp* and *A* + *lplp* respectively giving almond-biscuit and light-popcorn pods; the complementary genes *N* and *Br* for colourless hairs, *nn brbr* plants having brown hairs; *L* for lobed leaflet, incompletely dominant over *l* for entire leaflet; the complementary genes I_1 and I_2 for simple inflorescence, with an inhibitory effect on lateral-bud development, in contrast to i_1 and i_2 for compound inflorescence; *Tptp*, for swollen *v.* tapering fruit tip; the complementary genes S_1 and S_2 for rough *v.* glossy seeds and *Tt* for twining *v.* nontwining habit. The following linkages and map distances were found: *Pp* and *Bb*, 4·3 units; *Bb* and *Lplp*, 15·6; and *Pp* and *Lplp*, 19·4.

2732 LAMPRECHT, H.
The synonymy of the genes *Sh* and *D* with *J* and *B* for the seed coat colour of *Phaseolus vulgaris*.
Agri hort. genet., Landskrona 1960 : **18** : 205–08.

It is pointed out that Prakken's gene symbols *Sh* and *D* (1934), quoted by Feenstra [XXXI, 1058], are synonymous with Lamprecht's symbols *J* and *B*, respectively, originally proposed in 1932.

2733 DHARAMPAL SINGH & SAXENA, J. K.
A semi-dominant lethal leaf mutation in *Phaseolus aureus*.
Indian J. Genet. 1959 : **19** : 83–89.

An irregular-leaved mutant is described. The mutant yielded a few apparently *NN* phenotypes when selfed but these plants, which had extremely narrow leaves, died without flowering. The leaves of the *Nn* mutants were intermediate in shape between the short-lived homozygous dominant types and the normal *nn* types. In crosses of the normal x mutant, the pollen carrying the gene *N* seemed to be at a disadvantage as compared to that carrying *n*, since the frequency of mutants in the progeny was much lower than expected.

2734 SCHWARZE, P.
Über die gesteigerte Peroxydaseaktivität in gestörten *Phaseolus*-Artbastarden. **(The increased peroxidase activity in abnormal *Phaseolus* interspecific hybrids).**
Planta 1960 : **55** : 630–36.

Some evidence is presented indicating that the increased peroxidase activity in abnormal hybrids of *Ph. vulgaris* x *Ph. coccineus* results from an increase in the quantity of the enzyme.

2735 SCHWARZE, P.
Über die Fraktionierung des Protoplasmas von *Phaseolus*-Arten und *Phaseolus*-Artbastarden. **(Fractionation of the protoplasm of *Phaseolus* species and *Phaseolus* interspecific hybrids).**
Planta 1960 : **55** : 451–60.

The quotients, content of nucleic acid in the cytoplasmic particles/content of nucleic acid in the cytoplasmic ground substance and protein content of the particles/protein content of the ground substance, were lower for *Ph. vulgaris* than for *Ph. coccineus*. In *Ph. vulgaris* x *Ph. coccineus* hybrids which developed normally, the protein quotient was almost the same as that of *Ph. coccineus*, whilst the nucleic acid quotient was similar to that of the mother species. Hybrids with inhibited development showed a reduction in protein content especially in the nuclei and chloroplasts. These findings show that in the hybrids the nuclear genes of *Ph. coccineus* had considerable influence on the proportions of the protoplasmic components in the cytoplasm.

2736 DHALIWAL, A. S. & SALUNKHE, D. K.
Starch grain characteristics and amylose content in relation to pollination time and seed size, and germination behaviour in *Phaseolus* species.
Indian J. Genet. 1960 : **20** : 118–25.

Studies at Utah State College indicated that varieties of *Ph. lunatus* differ in starch grain size as well as in other characteristics. Burpee Bush and Concentrated Fordhook are large-seeded varieties and possess large starch grains, while Utah 16, Clark's Bush and Wasatch Bush are small-seeded and possess relatively small starch grains. *Ph. polystachyus* also has small seeds and small starch grains.

A linear relationship was found to exist between size and weight of seeds and size of starch grains.

As the pollination time advanced, the size of starch grains in the *Ph. lunatus* varieties tended to decrease. Seed and starch grains of F_1 hybrids derived from *Ph. lunatus* 'Fordhook' x *Ph. polystachyus* were similar in size to those of the large-seeded *Ph. lunatus* varieties.

Amylose content was more or less equal (24%) in both species but decreased to 15·06% in the F_1. The type of germination in the F_1 was intermediate between the epigeal germination of *Ph. lunatus* and the hypogeal germination of *Ph. polystachyus*.

2737 CARDONA, C., DUARTE, R. & MANCINI, S.
El uso de la radiación artificial en la agricultura y su aplicación al fríjol en Colombia. (**The use of artificial radiation in agriculture and its application to the kidney bean in Colombia**).
Agricultura trop. 1960 : **16** : 514–23.

Seeds of the varieties Panameño, Sangretoro, Algarrobo and Estrada Rosado [Pink Estrada] were irradiated at 5000, 7500 and 10,000 r. and then sown at the Palmira and Medellín Experiment Stations. A reduction in percentage germination and a number of leaf abnormalities were noted in the R_1, together with nine mutants of possible value. The latter included plants with increased vigour, extensive branching and a lengthened growth period. In the R_2 and R_3, however, no mutants with valuable characteristics were obtained.

Recent developments in the utilization of radiation in plant breeding are reviewed.

2738 **College Pride—a new variety of French bean.**
Agric. Gaz. NSW 1960 : **71** : p. 499.

Previously known as HAC–26, College Pride was developed at Hawkesbury Agricultural College and is a selection from the cross Hawkesbury Wonder x Granda. The new variety matures 3–5 days later than Hawkesbury Wonder and outyielded that variety and Brown Beauty in 1957–58 trials. The variety cannot replace Tweed Wonder as it does not possess the early setting habit under adverse climatic conditions. The pods, which are mid-green in colour, yield high-quality beans which remain "brittle and fleshy" even after transporting for long distances.

2739 **Seaway, new mosaic resistant navy bean.**
Crops & Soils 1960 : **13** : No. **2** : p. 18.

Seaway, developed at Michigan State University of Agriculture and Applied Science, is resistant to prevalent strains of common bean mosaic, to which Sanilac and Michelite are only partially resistant. It ripens 2–3 days earlier than Sanilac and 12–18 days before Michelite.

2740 RAEDER, J. M.
UI–74, a small white bean resistant to common bean mosaic virus.
Bull. Idaho agric. Exp. Sta. 1960 : No. 332 : Pp. 2.

UI–74, from a cross between the introduction Norida and a small flat white bean grown in the Clearwater River area in Idaho, has been developed to meet the demand for small white beans for canning. The variety is especially well adapted to the Clearwater River area. It may also be grown under irrigation in southern Idaho, provided curly-top virus, to which it is susceptible, is not a problem.

2741 SEN, N. K. & MURTY, A. S.
Effects of selection in tetraploid green gram varieties.
Euphytica, Wageningen 1960 : **9** : 235–42.

Compared with the corresponding diploids, the colchicine-induced tetraploids of three varieties of *Phaseolus aureus* had smaller leaflets with a lower length/breadth ratio, were shorter, flowered later and over a longer period, had fewer flower buds but produced more and larger flowers and developed fewer and smaller pods with fewer but larger and more protein-rich seeds. Positive and negative selection for vigour for three generations showed that leaf size, plant height, fruit set and seed weight could be improved, but not pod size or number of seeds per pod.

2742 WEISÆTH, G.
Samenmerkmale zur Identifizierung von Bohnensorten (*Phaseolus vulgaris* L.). [**Seed characters for the identification of bean varieties (*Ph. vulgaris* L.)**].
Mitt. int. Verein. Samenkontrol. 1960 : **25** : No. **1** : 341–53.

An illustrated survey of genetically determined seed characters is provided.

2743 ZAUMEYER, W. J.
A new race of bean rust in Maryland.
Plant Dis. Reptr. 1960 : **44** : 459–62.

A new race of *Uromyces phaseoli* var. *typica* which is highly infectious to bush snap beans is designated 32. Of 93 bean varieties, including 56 bush types, which were tested for reaction to the new race, 38 were homozygous for resistance. Only 5 of these were of the bush type: Stringless Green Refugee, US5 Refugee, Seminole, Tenderwhite and Tennessee Green Pod; only the last-named was immune. Heterozygous reactions were exhibited by the bush-types Extender, Green Crop, Sensation Refugee 1066, State Half Runner and Brittle Wax; some seedlings of Brittle Wax were immune.

2744 GALVEZ, G. E. & CARDONA A., C.
Razas de *Rhizoctonia solani* Kühn en fríjol. (**Races of *Rh. solani* Kühn in the bean**).
Agricultura trop. 1960 : **16** : 456–60.

Details are given of the pathogenicity of races A, B and C of *Rh. solani* (*Pellicularia filamentosa*) on *Phaseolus vulgaris*, *Ph. lunatus* and *Vigna sinensis*, three species widely cultivated in Colombia.

2745 FABIG, F.
Stand der Buschbohnenzüchtung für die maschinelle Ernte. (**The state of breeding dwarf beans for mechanical harvesting**).
Dtsch. Gartenbau 1960 : **7** : 151–53.

At the Plant Breeding Institute in Quedlinburg, new forms suitable for mechanical harvesting have been bred. These have upright growth and the pods hang thickly together well above the leaves. The pods can also be picked by hand twice as fast as those of other varieties. A flat-podded form and a round-podded form have outyielded older varieties including Saxa. Both forms show field resistance to anthracnose.

2746 MASTENBROEK, C.
A breeding programme for resistance to anthracnose in dry shell haricot beans, based on a new gene.
Euphytica, Wageningen 1960 : **9** : 177–84.

The black-seeded variety Cornell 49–242, which is immune from races α, β, γ and δ of anthracnose, has been subjected to crossing and back crossing with Netherlands varieties resistant to halo blight. The segregation data indicate that anthracnose resistance is determined by a single dominant gene, designated *Are*.

2747 SMITH, F. L. & HOUSTON, B. R.
Root rot resistance in common beans sought in plant breeding program.
Calif. Agric. 1960 : **14** : No. 9 : p. 8.

Sources of resistance to *Fusarium* root rot, due to two independent genes, one of which is dominant and the other recessive, are available for breeding at the California Agricultural Experiment Station, Davis.

2748 GUEVARA C., J., PATINO, G. & CASAS, E.
Selección de variedades de frijol resistentes al picudo del ejote. (**Selection of kidney bean varieties resistant to the bean weevil**).
Agric. téc. Méx. 1960 : No. 10 : 10–12.

Varieties which showed high resistance to *Apion godmani* in 1958–1959 trials at Chapingo, Mexico, were Pinto 162, Pinto 168, Negro 157 [Black 157], EAP88–B and a large number of hybrid lines.

2749 SAUNDERS, A. R.
Inheritance in the cowpea (*Vigna sinensis* Endb.) II. Seed coat colour pattern: flower, plant, and pod colour.
S. Afr. J. agric. Sci. 1960 : **3** : 141–62.

The testa colour patterns known as watson, holstein, eye and hilum ring appear to be the result of complementary action between three main genes, *W*, *H* and *O*. The various patterns are ascribed to the following genotypes: solid, *WHO*; watson *WhO*; holstein, *wHO*; small eye, *whO*; and hilum ring, *WHo*, *Who*, *wHo* or *who*. The same three genes also determine flower colour, the following being the suggested genotypes: pale, *wHO* or *whO*; tinged, *WHo* or *Who*; and dark, *WHO* or *WhO*. Dark flower colour is epistatic to pale and tinged. As regards the genes influencing pod colour, two are operative as follows: purple, *Pc*; cerise *pC*; and straw, *pc*. Purple pod is epistatic both to cerise and straw-coloured pod. Brown and speckled pod colours also exist in some varieties, e.g. Speckled and Mwandatu respectively. The genes for these two colours appear to be closely linked with that for speckled testa [cf. XXX, 4442].

2750 SEN, N. K. & BHOWAL, J. G.
Genetic studies in horse-gram.
Indian J. Genet. 1959 : **19** : 228–33.

According to data from a single intervarietal cross in *Dolichos biflorus*, black seeds and purple plant colour were dominant over brown seeds and green plants, and dependent upon a single gene or two closely linked genes. The earliness in flowering of the black-seeded parent was dominant over the later flowering of the brown-seeded one. The effective-gene difference was estimated as about 1·5 for time of flowering. Genes for pigmentation and time of flowering were inherited independently.

2751 SEN, N. K. & MARIMUTHU, K. M.
Colchiploids of *Dolichos lablab* L.
Caryologia 1960 : **13** : 411–29.

C_0 tetraploid sectors ($2n = 44$) of several varieties, resulting from treatment of the apical bud of seedlings aged 8–12 days, showed the usual *gigas* features [cf. XXX, 2066]. Meiosis was typical of autotetraploidy, but irregularity due to multivalent and univalent formation was not very pronounced. The 4*n* leaves were thick and fleshy, and invariably broader than those of diploids but, except in two varieties, were no longer. The growth period was longer as the result of tetraploidy. Seed fertility was comparatively good, the pods and seeds being larger although fewer in number than in the diploids. These preliminary observations, restricted to the C_0, suggest that it may be possible to develop 4*n* varieties which will be useful as fodder, vegetable or pulse.

2752 GROBBELAAR, W. P.
Soybeans can be successfully cultivated in the N.W. Free State.
Fmg. in S. Afr. 1960 : **36** : No. 7 : 47–49.

Varieties developed at the Potchefstroom College of Agriculture, Transvaal, have shown promise for grain and hay production in tests at the Agricultural Research Station, Kroonstad.

2753 JOHNSON, H. W.
Registration of soybean varieties, VII.
Agron. J. 1960 : **52** : 659–60.

The following varieties, recently registered cooperatively by the US Department of Agriculture and American Society of Agronomy, are described: Acme [XXV, 2850]; Bienville (Pelican 2 x Ogden), released in 1958 and especially well adapted in the lower south-eastern states where it has equalled or surpassed Lee, JEW 45 and Jackson in yield and seed quality; Comet [XXV, 2850]; Ford [XXIX, 3263]; Hill [XXX, 2076]; Hood [XXIX, 4640]; Lindarin [XXIX, 3260]; Merit [XXIX, 4638]; and Shelby [Lincoln x (Lincoln x Richland)] [XXIX, 2060].

2754 NAGATA, T.
Studies on the differentiation of soybeans in Japan and the world.
Hyogo Noka Daigaku Kiyo/Mem. Hyogo Univ. Agric. 1960 : **3** : 63–102.

From a study of the distribution of soya-bean types differing in respect of vegetative period and plant habit, the author sets out his conclusions on the evolution and dissemination of the soya bean in the Far East. Most of the results and conclusions of this paper have been summarized from the author's earlier publications [cf. XXI, 1446 and XXX, 3330].

2755 JOHNSON, H. W. & MEANS, U. M.
Interactions between genotypes of soybeans and genotypes of nodulating bacteria.
Agron. J. 1960 : **52** : 651–54.

The interactions of genotypes of *Rhizobium japonicum* with genotypes of soya bean, as indicated by chlorosis, are described.

2756 CALDWELL, B. E., BRIM, C. A. & ROSS, J. P.
Inheritance of resistance of soybeans to the cyst nematode, *Heterodera glycines*.
Agron. J. 1960 : **52** : 635–36.

The parents used were the resistant introductions Peking, PI90763 and PI84751 and the susceptible varieties Lee and Hill and experimental line D53–354, the last three parents being related. F_1 and F_2 data indicated that resistance was recessive and dependent upon three independent loci. Two back crosses of the type resistant x (resistant x susceptible) confirmed this hypothesis, which, however, requires to be verified by study of more advanced generations.

2757 Sortsforsøg med høje ærter 1956–58. **(Varietal trials of tall peas, 1956–58).**
Tidsskr. Planteavl 1960 : **64** : 361–64.

Ten marrowfats, two edible-podded marrowfat types and two sugar peas have been tested at two stations in Denmark. The varieties are described and details are given of their performance.

2758 JENSEN, J.
Sortsforsøg med høje ærter. 1956–58. **(Varietal trial of tall peas. 1956–58).**
Tidsskr. Planteavl 1960 : **64** : 515–25.

Data on pod and green-seed yield, growth characters and quality are given for 14 varieties tested at two stations in Denmark.

2759 RIEPMA WZN, P. & VEENBAAS, A.
Resultaten van de doperwtenrassenproef PAW 413 - 1960. **(Results of the shelling-pea varietal trial PAW 413 - 1960).**
Meded. Proefsta. Akker- en Weidebouw, Wageningen 1960 : No. 42 : Pp. 61. (Mimeographed).

Data on agronomic characters and quality after canning or freezing are given for 18 round-seeded varieties, ten wrinkled varieties with light-green seeds and 12 wrinkled varieties with dark-green seeds, tested in the Netherlands in 1960.

2760 Pavel, G.
Cele mai bune soiuri de mazăre cultivate pentru păstăi la Staţiunea Iaşi. (**The best pea varieties cultivated for their pods at the Iaşi station**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 149–57.

Nine varieties were compared, data being provided on vegetative period, plant habit, pod and seed characters, yield, chemical composition of the seeds and susceptibility to *Bruchus pisorum* and *Laspeyresia dorsana*.

2761 Ionescu, D., Popa, G. & Bantaş, S.
Linii noi de mazăre. (**News lines of pea**).
An. Inst. Cerc. agron., Bucureşti : Ser. C 1958 : **26** : 135–48.

Three new lines are described: ICAR124 [(Victoria Strube x Express) x Victoria Strube], an early high-yielding line producing an average of 885 kg./ha. of protein over a three-year period, ICAR54 [(Victoria Mahndorf x Timpurie de mai) x Victoria Mahndorf], with 29·8% protein, and ICAR33 [(Victoria Strube x Express) x Victoria Strube], also showing improvements in yield and protein production per ha.

2762 Laumont, P. & Chevassus, A.
Note sur l'amélioration du pois rond en Algérie. (**A note on the improvement of the round pea in Algeria**).
Ann. Éc. Agric. Alger 1960 : **2** : No. 1 : Pp. 23.

A botanical and agricultural classification of *Pisum sativum* ssp. *sativum* is presented and the methods adopted in Algeria for the improvement of the crop are outlined. Extensive details are also given of the varieties recommended for cultivation in Algeria.

2763 Lamprecht, H.
Studien zur Manifestation und Koppelung des Sterilität bedingenden Gens *Re* von *Pisum*. (**Studies on the manifestation and linkage of the sterility gene *Re* of *Pisum***).
Agri hort. genet., Landskrona 1960 : **18** : 181–204.

The gene *re* conditions sterility due to malformation of both andrecium and gynecium. Somatic mutation from *re* to *Re*, giving rise to fertile flowers in the upper part of the plant, occurred in all plants of the pure line investigated, but not in *rere* segregates from three crosses with other lines, indicating that mutation depended upon genetic background. In two of the crosses, partially fertile *re* plants were equal in seed yield to *Re* plants, while in the third they were inferior. *Re* appeared to be linked with *A* on chromosome I.

2764 Lamprecht, H.
Eine neue Stipel-Mutante bei *Pisum*. (**A new stipule mutant in *Pisum***).
Agri hort. genet., Landskrona 1960 : **18** : 209–13.

The recessive gene *stim* (*stipula imminuata*), which causes a diminution and alteration in form of the stipule, is hypostatic to both *S* and *st*, which also govern stipule form. The gene *stim* first appeared in association with semisterility.

2765 Lamprecht, H.
Zwei neue Chlorophyllmutanten von *Pisum*. (**Two new chlorophyll mutants of *Pisum***).
Agri hort. genet., Landskrona 1960 : **18** : 169–80.

A study of several generations of one cross has revealed two new single-gene mutations. The first, *chlorina-virescens*, is determined by *chves* and is characterized by a change in the seedlings from an initial *chlorina* colour to a final *virescens* colour. The second, *chlorina-virescens-chlorotica-terminalis* (*cvit*) gives plants behaving at first like *chves* plants and then becoming pale-green at the tip. The same cross showed a linkage of *Ch* with *Ust* and *Fs* in chromosome V.

2766 Joshi, B. S. & Singh, H. B.
A bloomless mutant in garden pea.
Indian J. Genet. 1959 : **19** : 236–37.

A single-gene recessive mutant bearing leaves without a waxy bloom was discovered in Early Badger at the Indian Agricultural Research Institute, New Delhi. A similar mutant has been noted in another variety, Asauji.

2767 Blixt, S.
Quantitative studies of induced mutations in peas. IV. Segregation after mutation.
Agri hort. genet., Landskrona 1960 : **18** : 219–27.

It has been shown previously that in a mutant plant from X-irradiated seed the mutation is generally restricted to part of a branch [cf. XXIX, 3273]. In the present paper, the types of segregation ratio expected in the X_2, X_3 and X_4 if the X_1 branch is composed partly of non-mutated *AA* tissue and partly of mutated *Aa* tissue are discussed and illustrated with reference to chlorophyll mutations obtained in pea. The results indicated that the ratio of mutated to nonmutated sector of the branch was about 1 : 1 in the material studied.

2768 LAMPRECHT, H.
Zwei bemerkenswerte genbedingte Chimären von *Pisum.* (**Two noteworthy gene-conditioned chimeras of *Pisum***).
Agri hort. genet., Landskrona 1960 : **18** : 125–34.

Seeds with marbled (*M*) and nonmarbled (*m*) testas were found on a single *M* mother plant. Analysis of the progeny indicated that in the presence of *mex mex* zygotes, *M* mutates to *m* and such plants either die early or become sterile dwarfs. The name *alterno-marmorata* is given to marbled chimeras of this type.
In the second chimeral type, named *infecunda*, which occurs in a line homozygous for *re*, mutation of *re* (sterile flowers) to *Re* (fertile) occurs towards the upper part of the plant [cf. 2763].

2769 GELIN, O.
W : s original Weitor yellow cooking pea and W : s original Marma fodder pea.
Agri hort. genet., Landskrona 1960 : **18** : 228–33.

Weitor, developed from a cross between the high-yielding dry-pea variety Kloster [Cloister] and the very early green-pea variety Early Norrland, yields almost as much as Torsdags III [Thursday III] and Strål [Ray], but has ripened five days earlier than the former and seven days earlier than the latter at Weibullsholm. A description of Marma has already been summarized [XXX, 3339].

2770 PČELAROV, V.
(**Promising varieties of garden pea obtained by open cross pollination**).
Naučn. Trud. selskostopan. Akad. Georgi Dimitrov. Agron. Fak. (Sci. Trans. G. Dimitrov Agric. Acad. Agron. Fac.) 1958 : **5** : 103–14. [Bulgarian].

The two varieties, Sofia 135 and 330, developed by open cross pollination of Russian and French varieties have shown promise both for direct consumption and for canning; they are little branched, uniform in maturity, thus allowing mechanical harvesting, and are good in quality.

2771 ZAGIKA, K. K.
(**A state varietal field station introduces new varieties**).
Selekcija i Semenovodstvo (Breeding & Seed-growing) 1959 : No. 5 : 44–47. [Russian].

Among the new cultivars multiplied for introduction trials in the Čerkassk province is the pea Uladovskij Rannij [Uladovo Early]. It is as productive as Ramon' 77 and exceeds it in earliness; it has large seed.

2772 VINOKUR, I. S.
(**Peas from the Bronze Age**).
Priroda (Nature), Leningrad 1960 : No. 8 : p. 102. [Russian].

Carbonized remains of peas dating back to 2700–2100 BC among archeological finds in the Cernovcy province of the Ukraine have been identified as *Pisum sativum* ssp. *asiaticum.*

2773 LAMM, R.
Studies on chromosome 1 in *Pisum.*
Hereditas, Lund 1960 : **46** : 737–44.

The maximum association observed by the author in the F_1 of Lamprecht's lines 379 x 21 consisted of one ring of six chromosomes + 4_{II}. This finding gives further support for his view that the chromosomes designated V and VII by Lamprecht and Blixt are different sectors of I and that I contains both *Gp* and *R* [XXIX, 4660–61].

2774 GELIN, O.
Breeding problems in field peas.
Agri hort. genet., Landskrona 1960 : **18** : 214–18.

Pea breeding at Weibullsholm Plant Breeding Institute, Sweden, is briefly surveyed. It is particularly noted that reliability of yield appears to be related (*a*) to favourable branching habit, as in Strål [Ray], and (*b*) to number of nodules per plant. Three-year tests of the progeny of crosses between Monopol, which forms abundant nodules, and Strål showed that variation between years was about 16% in plants with an average of 14 nodules per plant but only about 5% in those with an average of 116. There was also evidence of a direct positive relation between yield and nodule number.

2775 TUVESON, R. W. & GARBER, E. D.
Experimentally induced alterations in nuclear ratios of heterocaryons of a phytopathogenic fungus, *Fusarium oxysporum* f. *pisi.*
Genetics 1960 : **45** : p. 1015. (Abst.).

In two heterocaryons involving diauxotrophic strains, it was possible, by supplementation, to alter the frequency of spores with the "dominant" nucleus so that an increasing number of spores with the "recessive" nucleus was obtained. The concentration of the supplement required for the production of spores with only the recessive type of nucleus differed in each heterocaryon, although the heterocaryons had a common recessive nucleus.

2776 DHARAMPAL SINGH & RADHEY SHYAM
Genetics of two new mutants in *Cicer arietinum*.
Indian J. Genet. 1959 : **19** : 73–82.

The morphology and genetics of the two mutants, bunchy and tiny-leaved-2, are described. Both proved to be simple recessives to the normal type. Bunchy, designated as *bu*, is unstable and exhibits a tendency to revert back to the normal *Bu*. The tiny-leaved mutant, designated as t_{1v}, breeds true and does not revert back to the normal T_{1v}. The cross between the two mutants gave a dihybrid segregation, including the normal type (BuT_{1v}) and a new type, bunchy-tiny-leaved ($bubut_{1v}t_{1v}$).

2777 MEENAKSHI, G. & SUBRAMANIAM, M. K.
Tandem satellites in *Cicer arietinum* Linn.
Curr. Sci. 1960 : **29** : 438–39.

The morphology and origin of tandem satellites, found in root-tip material of *C. arietinum*, are discussed briefly.

2778 MATHUR, R. S., JAIN, J. S. & ATHEYA, S. C.
Resistance of gram varieties to *Fusarium* wilt in Uttar Pradesh, 1949–1958.
Curr. Sci. 1960 : **29** : p. 403.

Ninety-five varieties of *Cicer arietinum* are classified with respect to their reaction to natural infection with *F. orthoceras* var. *ciceri* at the Laboratory of the Plant Pathologist, Kanpur.

2779 PAVEL, I. G.
Linii noi de linte pentru boabe. (**New lines of lentil**).
Stud. Cercet. şti : Biol. Şti. agric. Iaşi 1960 : **11** : 125–31.

Eight lines obtained by individual-plant selection were tested, data being collected on yield and chemical composition of the seed. Two promising lines, Iaşi 52/1 (selection of Linte de Moldova) and Iaşi 52/7 (selection of Linte de Vinga), are recommended for trial in Moldavia.

2780 LAUMONT, P. & CHEVASSUS, A.
Notes sur l'amélioration de la lentille en Algérie. (**Notes on the improvement of the lentil in Algeria**).
Ann. Éc. Agric. Alger 1960 : **2** : No. **3** : Pp. 35.

Among the topics dealt with are the historical and present significance of *Lens esculenta*, the aims and methods of the breeding programme at the Central Seed and Plant Breeding Station, Maison-Carrée, Algeria, morphological features of the plant, and the botanical and agronomic classification of the species with particular reference to Algerian varieties. A number of these varieties, recently selected at the above station, are described.

2781 KANDASWAMY, T. K. & RAMAKRISHNAN, K.
An epiphytotic of pigeon pea sterility mosaic at Coimbatore.
Madras Agric. J. 1960 : **47** : 440–41.

No signs of tolerance or resistance to sterility mosaic virus were noted in a group of over 100 varieties of *Cajanus cajan*, grown at the Millets Breeding Station, Coimbatore, India.

2782 **Two new popcorn varieties released.**
Crops & Soils 1960 : **13** : No. **2** : p. 18.

The release of the yellow popcorns P410 and P632 by Purdue University is announced. P410, with midseason maturity, is recommended for the central and southern areas of Indiana, Ohio and Illinois. When popped, 60% of the flakes are of the "mushroom" type. The confectionery industry may therefore find considerable use for P410. A full-season hybrid, P632 is suitable for the southern parts of the above-mentioned states. It is a dent-sterile version of P32, its genetic constitution being such that it cannot be contaminated by dent maize.

2783 SACCO, T.
Una nuova forma di menta, *Mentha viridis* (L.) L. cultivar x *lavanduliodora* Sacco, n. cult. [**A new form of mint, *M. viridis* (L.) L. cv. x *lavanduliodora* Sacco, n. cult.**].
Allionia, Torino 1959 : **5** : 185–94.

By mass selection within a seed population from the Piedmont area of Italy, a strain has been produced which differs from any previously known botanical variety and is therefore described. Its essence, which has an agreeable scent reminiscent of lavender, contains up to 54·92% of linalool.

2784 IKEDA, N., UDO, S. & NAKAMURA, M.
(**Studies on *Mentha spicata* L. var. *crispa* Benth. Genome analysis in *Mentha*. I**).
Ikushugaku Zasshi/Jap. J. Breeding 1960 : **10** : 89–95. [Japanese].

Meiosis in F_1 hybrids between 48 and 54-chromosome races of Japanese samples of the above variety, and between each of these races and *M. rotundifolia* ($2n = RR = 24$) are described. The modal meiotic configurations were: *M. spicata* ($2n = 48$) x *M. spicata* ($2n = 54$), $24_{II} + 3_{I}$ and $25_{II} + 1_{I}$; *M. spicata* ($2n = 48$) x *M. rotundifolia*, $12_{II} + 12_{I}$; and *M. spicata* ($2n = 54$) x *M. rotundifolia*, $12_{II} + 15_{I}$ and $13_{II} + 13_{I}$. It is concluded that the genome constitutions of the two races of *M. spicata* can be designated RRS^cS^c and $RRS^cS^c\alpha_1\alpha_1\alpha_2\alpha_2\alpha_3\alpha_3$, where α_1, α_2, α_3 represent semihomologous supernumeraries. The common assumption that *M. spicata* var. *crispa* was introduced into Japan from Europe is questioned, especially as Nakao found a 48-chromosome race of this variety in Bhutan in 1958.

ECONOMIC LOWER PLANTS

2785 Balassa, R.
Transformation of a strain of *Rhizobium lupini*.
Nature, Lond, 1960 : **188** : 246–47.

Transformations of *Rh. lupini* with respect to cysteine independence and change in host specificity are reported from the Institute for Genetics, Hungarian Academy of Sciences, Budapest. The DNA used was derived from a strain of the same species in the case of the first property and from *Rh. meliloti* in the case of the second.

2786 Alikhanian [Alihanjan], S. I., Iljina, T. S. & Lomovskaya [Lomovskaja], N. D.
Transduction in Actinomycetes.
Nature, Lond. 1960 : **188** : 245–46.

Prototrophs of *Actinomyces* (*Streptomyces*) *olivaceus* were obtained from the recipient auxotrophs, His$^-$ Met$^+$, His$^+$ Met$^-$ and Cys$^-$ His$^+$, treated with actinophage grown on the donor auxotrophs, His$^+$ Met$^-$, His$^-$ Met$^+$ and Cys$^+$ His$^-$, respectively. In each combination, the prototrophs were of two types. The first gave rise only to further prototrophs, whereas the second segregated into (1) prototrophs, (2) auxotrophs with the nutrient deficiency of the donor, (3) auxotrophs of the recipient type and (4) auxotrophs with the deficiency of both donor and recipient. Some variants continued to segregate into colonies of all four types, while others produced only one or two of the types. After one or two transfers, however, stable nonsegregating lines of all four types were secured. Possible genetical causes of the segregation are discussed.

2787 Fantini, A. A. & Olive, L. S.
Sexual recombination in a homothallic, antibiotic producing fungus.
Science 1960 : **132** : p. 1670.

Conclusive evidence of cross fertilization and recombination between two ultraviolet-induced mutants of *Emericellopsis salmosynnemata*, which produces synnematin B, is reported. The genotypes of the mutants were respectively al–4 lys^-–1 ser^+ f^+ (albino, lysine-requiring and fluffy mycelium) and al^+–4 lys^+–1 ser^- f (wild-type colour, serine-requiring and flat mycelium). Almost all the expected recombinant types were recovered. Both parents had low antibiotic activity. Reconstitution to prototrophy by meiotic recombination failed to reestablish the original antibiotic-yielding capacity of the wild type. Possibly several factors active in the synthesis of the antibiotic may be linked with the chromosome carrying f^+ for fluffy mycelium. Mycelial colour appeared to have no effect on antibiotic yield.

2788 Elander, R. P.
Studies on antibiotic producing species and varieties of *Emericellopsis* and *Cephalosporium*.
Diss. Abstr. 1960 : **21** : LC Card Mic 60–2424 : 30–31. (Abst.).

The investigations were mainly concerned with natural and ultraviolet-induced variability in *E. salmosynnemata* and *E. terricola* var. *glabra*. Ultraviolet radiation had a highly effective mutagenic action on the latter organism, several mutants with an improved capacity to produce antibiotic being obtained.

2789 Kasatkina, I. D.
(The morphology of aminoacid-deficient variants of *Aspergillus niger* in connexion with the composition of the medium).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 501–04. [Russian].

Ultraviolet-induced mutants deficient for arginine, lysine, tryptophane or methionine reverted to the morphological characters of the parent strain on being cultured on wort agar to which the deficient aminoacid had been added. This morphological change was accompanied by improved growth and conidial development.

2790 Loginova, L. G.
(The activity of the hydrolytic enzymes of the *Aspergillus nidulans* variant obtained by irradiation with ultraviolet rays).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 683–89. [Russian].

The ultraviolet-induced mutant n/7 was a more active producer of protease, amylase, pectinase and cytase than the parent strain. The greatest difference between the strain and its mutant form was in respect of proteolytic enzymes.

2791 Cojacaru, C. & Iliesca, V.
Selecţionarea unor rase de drojdii specifice fabricării spirtului din cereale (porumb) si melasă. [**The selection of some races of yeast for manufacturing alcohol from cereals (maize) and molasses**].
Lucr. Inst. Cerc. aliment. 1959 : **3** : 19–33.

Fermentation trials involving an extensive series of yeast strains are reported. The best strain for fermenting maize was 50ICA and for molasses, 60ICA.

2792 Takahashi, T.
(**Genetic segregation of 3-ploid yeast obtained by the minimal plate mating technique**).
Idengaku Zasshi/Jap. J. Genet. 1959 : **34** : 392–400. [Japanese].

Of two 3*x* strains obtained by mating a homothallic 2*x* strain of *Saccharomyces chevalieri* with a heterothallic *x* strain of *S. cerevisiae*, one was sufficiently fertile for tetrad analysis in respect of *D*, *AD*, *AR*, *GA*, *SU*, *MA* and *ME*. Various anomalous segregation ratios were obtained, which are attributed to differential univalent elimination.

2793 Hawthorne, D. C. & Mortimer, R. K.
Chromosome mapping in *Saccharomyces*: centromere-linked genes.
Genetics 1960 : **45** : 1085–1110.

"Extensive linkage studies in *Saccharomyces* were undertaken with more than 70 genes controlling nutritional requirements, fermentation of sugars, resistance to metals, and colonial characters. The emphasis was on the comparison of centromere linked markers, detected through tetrad analysis, to obtain an estimation of the minimal haploid chromosome number. Seventeen genes that showed a significant degree of centromere linkage were compared and found to fall into ten linkage groups which segregated independently. Another nine genes showing significant linkage to the centromere markers were placed on the maps of these chromosomes. There were five more genes with at least a suggestion of centromere linkage (a second division segregation frequency less than 67 per cent) which remain unmapped.

"An analysis of chiasma and chromatid interference was made for four of the linkage groups. Chiasma interference was not observed in three groups comprised of regions spanning the centromere, while a coincidence value of 0·34 was observed for the linkage group with regions restricted at a single arm. For the latter group, as well as one of the three groups encompassing the centromere, the frequency of two-strand and four-strand double crossovers was greater than expected on the basis of a 1 : 2 : 1 distribution of two-, three-, and four-strand multiple exchanges.

"An analysis of five hybrids heterozygous for centromere markers on as many as nine chromosomes revealed only one exception to the independent assortment of the chromosomes. In this one hybrid, a single pair of non-homologous centromeres segregated preferentially in the parental combination."

[Authors' summary].

2794 Harris, G. & Thompson, C. C.
Alleged transformation of yeast.
Nature, Lond. 1960 : **188** : 1212–13.

Oppenoorth has reported that DNA from a donor *Saccharomyces* strain, when added to the growth medium, may confer fermentative properties upon an acceptor strain. Further investigation, using the donor and acceptor strains originally employed by Oppenoorth, has however suggested that his interpretation of the phenomenon as transformation may not be valid. Studying transfer of the capacity to ferment sucrose, the authors found that contamination of the DNA with invertase in sufficient quantity to lead to the formation of monosaccharides was responsible for the positive behaviour of acceptors in the sucrose-fermentation test, and that the presence of DNA in the growth medium was not necessary for a positive result in this test. The fermentation tests applied by Oppenoorth are therefore considered to be inadequate as a means of providing proof of transformation.

2795 Fogel, S. & Hurst, D. D.
Coincidence relations between gene conversion and somatic recombination in *Saccharomyces cereviseae*.
Genetics 1960 : **45** : p. 987. (Abst.).

In diploids heteroallelic for an adenine marker (ad_6) and containing a system for "signalling" conversional events, coincidence relations between conversion and homozygosis among other nonlinked markers were analysed in ultraviolet-treated and control populations. Among 87 cases of conversion at site ad_6, 10 were instances of coincident homozygosis for an unlinked uracil marker (*ur*). The behaviour of linked outside markers indicated that the conversion event was essentially nonreciprocal. A disturbance in normal centromeric behaviour was, however, indicated. Conversions frequently arose as sectored clones, "and homozygosis via somatic recombination, a reciprocal process, for unlinked markers might be expected to be distributed by a conventional mitotic mechanism." The frequency of homozygosis for *ur* was about ten times greater among conversions than among nonconversions with a given dose of ultraviolet irradiation.

2796 Fogel, S. & Hurst, D. D.

Coincidence relations of somatic recombination in *Saccharomyces cerevisiae.*

Genetics 1960 : **45** : p. 987. (Abst.).

Utilizing the $(ad_2/ad_2\ Ad_x/ad_x)$ "mutation signal system (red to white clone)", coincidence of homozygosis for unselected, nonlinked markers was investigated in ultraviolet-treated and control populations. The frequency of coincident events, i.e. simultaneous homozygosis at the Ad_x "signal" locus and other nonlinked loci, was found to be at least ten times greater than anticipated on the assumption of random independent events. For the majority of cases of coincidence, nonhomologous chromosomes appeared to be distributed in a normal fashion. In some instances, however, a distinctly polarized segregation was detected. The high coincidence values, together with directed segregations, suggest an interchromosomal effect in somatic recombination.

2797 Roberts, C. & van der Walt, J. P.

Investigations on maltose utilization in *Saccharomyces.* I. The acquisition of maltose fermentative ability by *S. capensis.*

CR Lab. Carlsberg 1960 : **32** : 19–34.

S. capensis, a nonfermenter of maltose, acquired the ability to utilize this sugar by a mutation designated $m \rightarrow M$. The progeny of a hybrid between the nonfermenting mother type and the fermenting mutant showed 2 : 2 segregation, indicating that only one gene was involved. It is not known whether this gene is identical with any of the other *M* genes already described in various species of *Saccharomyces.* The problem of aberrant maltose utilization is discussed, particularly with respect to its taxonomic implications.

2798 Takahashi, T.

Filtration methods for selecting auxotrophic mutants of flocculent type yeast.

Seiken Jiho/Rep. Kihara Inst. biol. Res. 1959 : No. 10 : 57–62.

The flocculent strain *Saccharomyces cerevisiae* 'G–8212' was irradiated with ultraviolet light and the survivors incubated in a minimal medium at 250° C. and filtered every 24 hr. through a No–3 glass filter to concentrate the auxotrophic mutants. The frequency of mutant recovery was 5–10 x 10^2. The mutants were deficient for cystine, histidine, methionine, tryptophane or adenine synthesis.

2799 Pittman, D., Webb, J. M., Roshanmanesh, A. & Coker, L. E.

Evidence for the genetic control of photoreactivation.

Genetics 1960 : **45** : 1023–37.

"Extrachromosomal mutations in yeast affecting respiratory ability are induced by ultraviolet radiation in haploid stocks carrying either the dominant or recessive allele of a gene (*r*) controlling respiratory competance. Photoreactivation of the mutation depends on the allelic state of the gene: In stocks carrying the dominant allele *r*+, the mutation is photoreactivable; in stocks carrying the recessive allele *r*, the mutation is nonphotoreactivable. The photoreactivable *vs.* nonphotoreactivable character of the mutation in question segregates in typical Mendelian fashion and as if controlled by the *r* gene pair. The photoreactivable trait is expressed as a dominant character in the heterozygote."

[Authors' summary].

2800 Nečas, O.

The structure of the nuclei of growing naked yeast protoplasts.

Folia biol., Praha 1960 : **6** : 233–38.

Observations were made on flattened protoplasts using a phase microscope and comparisons made with stained specimens. The nucleus was found to be surrounded by a membrane and to contain a nucleolus.

2801 Mundkur, B.

The nature and distribution of submicroscopic basophile particles in yeast.

Genetics 1960 : **45** : p. 1002. (Abst.).

Electron-microscopic examination of haploid and diploid *Saccharomyces* cells revealed vesicular nuclei with no chromosomes as observed by means of the light microscope, but instead, a complex organization of submicroscopic basophilic components whose genetic homologies have been considered [cf. XXX, 2124].

2802 Desborough, S., Shult, E. E. & Lindegren, C. C.
Interference patterns in a *Saccharomyces* family.
Genetics 1960 : **45** : p. 984. (Abst.).

Desborough, S., Shult, E. E., Yoshida, T. & Lindegren, C. C.
Interference patterns in family Y-1 of *Saccharomyces*.
Genetics 1960 : **45** : 1467–80.

Both chromatid and chromosomal interference were revealed in chromosome I of *S. cerevisiae* by tetrad analysis of a hybrid heterozygous for five genes, the gene order being *UR* – centromere – *TZ* – (*AG, IS*) – *NI*. Strong "negative" chromatid interference occurred in the portion of the chromosome distal to *TZ*. It was shown that this effect was not the result of faulty assignment of gene order nor of nonadditivity caused by quasilinkage. An extreme excess of localized single exchanges occurred in the segment centromere – *TZ*. Proof was obtained that this excess was true chromosomal interference rather than the result of an excess of 3-strand doubles. The localized exchanges did not engage in the "negative" chromatid interference pattern in the portion of the chromosome distal to *TZ*.

2803 Geerts, S. J. & Stumm, C.
Prüfung der Kernwertigkeit polyploider Hefen mit der Massenisolationstechnik. (**Testing the ploidy of polyploid yeasts with the mass selection technique**).
Naturwissenschaften 1960 : **47** : 210–11.

The mass selection technique has been reported elsewhere [cf. XXX, 927]. Ploidy is determined by the segregation ratios of the pairing-type alleles in single-spore cultures. For a heterothallic triploid with the genotype $a\ a\ \alpha$, the ratio of $a\alpha$: a': α is 2 : 3 : 1, where a′ includes a and aa types. Similarly the genotype $a\alpha\alpha$ should segregate $2a\alpha : 1a : 3\alpha'$ ($\alpha' = \alpha$ and $\alpha\alpha$ types). Assuming that only single-spore cultures are formed, the tetraploid ($aa\alpha\alpha$) should segregate $4a\alpha : 1aa : 1\alpha\alpha$. A triploid ($a\alpha\alpha$) and a tetraploid ($aa\alpha\alpha$) gave segregation ratios agreeing well with the expected ratios. Two spore-forming but nonconjugating single-spore isolates from the tetraploid segregated $18a : 16\alpha$ and $17a : 18\alpha$ respectively and were therefore diploid. A series of other polyploid yeasts have also been tested in this way.

2804 Sarachek, A.
The induction by ultraviolet radiation and the photoreactivation of heritable respiratory deficiency in polyploid *Saccharomyces*.
Cytologia, Tokyo 1959 : **24** : 507–15.

The rate of the induction by ultraviolet radiation of extrachromosomally inherited respiratory deficiency in *S. cerevisiae* was found to be positively correlated with the ploidy level of the cells involved. The fraction of the radiation damage which is photoreactivable is similarly related to ploidy. These findings are taken to indicate that the primary radiation events which result in inactivation or loss of the extrachromosomal genetic determinants of cellular respiration are nuclear in nature.

2805 Wicketham, L. J. & Burton, K. A.
Heterothallism in *Saccharomyces rouxii*.
J. Bact. 1960 : **80** : 492–95.

Mating types of *S. rouxii* were obtained from two samples of Japanese soya-bean paste. Smooth glistening colonies and mat often-rugose colonies were obtained. Opposite sexes of the glistening type mated well but there was little mating amongst the mat types or between mat and glistening types. The mat type appears to have a greater tendency to produce diploid cells than the glistening type and the diploid cells develop aborted asci.

2806 Palleroni, N. J. & Gómez, R. A.
Estudio de una modificación del medio de Fowell para la esporulación de levaduras. (**Study of a modification of Fowell's medium for yeast sporulation**).
Rev. Fac. Cienc. agrar., Mendoza, 1958 : **7** : 63–69.

The addition of autolysed yeast to Fowell's medium generally led to an increase in the number of asci produced by various strains of *Saccharomyces cerevisiae* var. *ellipsoideus*. Some interstrain differences were noted, indicating that the strains concerned had somewhat different requirements for maximum sporulation. The application of a heavy inoculum of yeast cells to the medium was found to induce more sporulation than a light inoculum.

2807 Palleroni, N. J.
Ascos de mas de cuatro esporas en *Saccharomyces*. (**Asci with more than four spores in *Saccharomyces***).
Rev. Fac. Cienc. agrar., Mendoza 1958 : **7** : 81–83.

About 2% of the asci in strain 20SJ of *S.*

cerevisiae var. *ellipsoideus* contained between 5 and 11 ascospores.

2808 Rojter, A. M., Berzina, N. I., Baširova, R. S. & Ren'kas, N. M.
(The comparative activity of the yeast strains Krasnodar and Krasnodarskie Drožži Solenye (KDS) in the preparation of diluted yeasts).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 598–99. [Russian].

Krasnodarskie Drožži Solenye [Krasnodar Salt Yeast] was less inhibited than the other strain by the addition of 0·8% salt to the liquid culture; it produced a more porous bread of greater volume in the presence of salt and was superior in this respect to the other strain.

2809 Fritz-Niggli, H.
Röntgenstrahleninduzierte Rückmutationen ("Punktmutationen") bei *Schizosaccharomyces Pombe* in Abhängigkeit vom Zellzustand, Bestrahlungsmilieu und Agens der Vorwärtsinduktion. [**Reverse mutations (point mutations) induced by X rays in *S. pombe* as influenced by condition of the cell, environment during irradiation and the agency inducing the forward mutation**].
Naturwissenschaften 1960 : **47** : 429–30.

Two adenine-deficient mutants, 407 and M_2, thought to represent identical mutons though induced by different agencies, when irradiated with X rays, gave back mutations at the rate of 0·1–0·4 x 10^{-11}. The rate was lower in resting than in dividing cells. In M_2 the rate was reduced by an atmosphere of N; moreover, spontaneous back mutation occurred in M_2 but not in 407.

2810 Čalenko, D. K. & Korsakova, T. F.
(Organisms which actively reduce acidity in apple juices and cider).
Mikrobiologija (Microbiology), Moskva 1960 : **29** : 587–94. [Russian].

Morphological and physiological descriptions are given of several *Schizosaccharomyces* strains which have recently been selected in the south of the Soviet Union. Most are active fermenters and oxidize malic acid, thereby causing an appreciable reduction in the acidity of apple juice and cider. Strains reducing the amount of acid to 80·5 and 97·8% of the original content are listed.

BOOK REVIEWS

2811 Scheffé, H.
The analysis of variance.
John Wiley & Sons, Inc., New York and Chapman & Hall, Limited, London 1959 : 112s. : Pp. xvi + 477 : figs. : tables.

This book is said to be intended for a two-term course at the graduate level, and for self study. The reviewer considers this must refer to mathematics graduates rather than biologists, for the level of mathematical proficiency required in the reader as defined in the preface, "a course in calculus at some time in the past and at least occasional use of mathematical notation in the present", will seem an understatement to many, even though useful appendices on vector and matrix algebra are provided.

The first part concerns the analysis of variance for models with fixed effects, including discussions of multiple comparisons and the analysis of covariance. The second covers random, mixed and randomization models with a consideration of the effects of departures from the underlying assumptions. Footnotes suggest further study for the more mathematically advanced reader and there is a useful range of problems with each chapter. The author's geometrical approach is manipulated with matrix notation throughout.

This expensive book will prove of most value to those who already have a working knowledge of the analysis of variance. Familiarity of technique is too rarely accompanied by a full realization of the implications of the various mathematical models which may arise, the appropriate tests of significance, and the effects of departures from the assumptions about distributions that are required. Up to now the statistician's only recourse has been to widely scattered and frequently difficult papers in the literature; Professor Scheffé's book is most welcome as the first unified and rigorous presentation of this theory, though few biologists will feel capable of handling the mathematics involved.

2812 YATES, F.
Sampling methods for censuses and surveys.
Charles Griffin & Co. Ltd., London 1960 : 3rd Ed. : 54s. : Pp. xvi + 440 : tables.

The first edition of this well-known work appeared in 1949 [XXI, p. 448] and the second edition in 1953 [XXIV, p. 481]. The book covers all the modern developments of sampling theory which are of importance in census and survey work and is written primarily for those who have little or no previous training in mathematical statistics. The general discussion is illustrated by numerical examples, the majority of which have been drawn from agricultural surveys.

The only major difference between this edition and the previous one is the inclusion of a chapter on electronic computers. This chapter outlines the main features of general-purpose electronic computers and indicates their value in the present context.

2813 HOEL, P. G.
Elementary statistics.
John Wiley & Sons, London & New York 1960 : 44s. : Pp. vii + 261 : figs. : tables.

This book is intended as an introduction to statistics for those with little or no mathematical training. Virtually no mathematical techniques are used and the approach is based on the consideration of practical problems. Although the approach is elementary, the author rightly introduces, as early as chapters 6 and 7, the logical problems of estimation and hypothesis testing. The main topics discussed are the usual 1 and 2 sample t tests, binomial distribution, regression and correlation; in addition four supplementary chapters are devoted to sketching the ideas of χ^2 tests, nonparametric tests, the analysis of variance and time series and index numbers. The reviewer found the approach clear and stimulating and recommends the book as a good introduction for the nonmathematician.

2814 LINDER, A.
Statistische Methoden. (**Statistical methods**).
Verlag Birkhäuser, Basel/Stuttgart 1960 : SFr. 54.–. : Pp. 484 : 58 figs. : tables.

At a time when the statistical methods now universally used in English-speaking countries were eyed somewhat askance in central Europe, the author, Professor of Mathematical Statistics at Geneva, published the first edition of the above work in 1945. This was followed by another work, *Planen und Auswerten von Versuchen*, first published in 1953 and reviewed in this journal [XXV, p. 261]. These two volumes were and still are among the best hand books of statistical procedures available in German.

The subject matter of the present edition is, of course, much the same as in corresponding books written in English. There are nine sections. The first outlines the basic notions of frequency distribution, mean, variance and orthogonal comparison. The second deals with sampling, estimation of statistical parameters, testing of hypotheses and confidence limits. Section 3 is mainly concerned with the uses of χ^2. The next two sections cover the significance of mean and variance, tests of the significance of differences between means and between variances, and variance components. Regression, correlation, covariance analysis, discriminatory analysis and Mahalanobis' generalized distance are treated in section 6. The estimation of parameters is considered further in section 7, which also deals with scale transformations. A short section follows on the technique of using desk calculators, and the final section expounds the mathematical theory underlying the foregoing exposition. A bibliography and set of statistical tables bring the volume to its conclusion.

The topics selected for treatment are dealt with in considerable detail; perhaps the main omission, in a book primarily intended for research workers, is the absence of any reference to nonparametric tests.

2815 PETERS, J. A. (Editor).
Classic papers in genetics.
Prentice-Hall International Inc., London 1959 : 30s. : Pp. vi + 282 : figs. : tables.

The papers reproduced in this volume constitute what the editor regards as the milestones in the development of the science of genetics. Each is prefaced by a short essay by the editor, pointing out the part the paper in question has played in the development of genetic thought or technique. Starting with translations of the famous paper of Mendel and of the summary of Johannsen's paper on pure lines, it passes to those of Sutton on the chromosomes in heredity, of Bateson and Punnett on the physiology of heredity and of Morgan and Sturtevant on sex linkage. The beginnings of studies on the physiology of gene action are illustrated by Wright's paper on colour inheritance, mutation studies by the early papers of Dunn and Muller, chromosome balance by that of Bridges on sex inheritance and position effect by that of Sturtevant on the bar locus in *Drosophila.* Induced mutations come in Muller's short paper of 1927 on the transmutation of the gene, in connexion with which the editor remarks that "the X-ray machine has become as common a piece of equipment in a genetics laboratory as is the microscope in histology". The paper by Creighton and McClintock on correlation of cytological and genetical crossing over is described as a cornerstone in experimental genetics. "Mastery of this paper", the editor assures us, "can give one the strong feeling of being able to master almost anything else he might have to wrestle with in biology". There follow papers by Painter on salivary gland chromosomes, Bridges on gene duplication, Beadle and Tatum on biochemical genetics in *Neurospora,* Avery and others on pneumococcal transformation and Lederberg and Tatum on recombination in bacteria. Other topics covered include genetic effects of atomic bombs, mutable loci in maize, the one-gene - one-enzyme hypothesis and the genetics of man. The papers reproduced also include that of Watson and Crick on the structure of nucleic acids and that of Fraenkel-Conrat and Williams on the reconstitution of tobacco mosaic virus.

2816 Sirks, M. J.
New Castle Lectures.
Martinus Nijhoff, The Hague 1959 : f. 5.75 : Pp. 75 : 26 figs.

The volume comprises the text of two lectures delivered at King's College, Newcastle-upon-Tyne in March, 1958. Hence presumably the picturesque title.

The first lecture gives an historical outline of the development of the science of genetics, starting with the work of Mendel, and emphasizing the importance of biochemical genetics and population studies; contributions of cytogenetics to sciences such as taxonomy and evolution and in the improvement of plants and animals, including man, are also mentioned. The second lecture deals largely with various hypotheses of gene structure and action. The lecturer leans toward the view that "the real gene should be considered to be a complex of protein and DNA". A number of cases of cytoplasmic inheritance are referred to but in discussing the possible existence of plasmagenes the lecturer states "these elements analogous to and comparable with nuclear genes, thus far are not known". English readers will probably find the text, of which the above extracts are a representative sample, difficult to read because of its complete departure from English usage in respect of syntax, punctuation and orthography. Thus we constantly meet such expressions as donot, cropplants, backside, segregationphenomena and chromosomebreakages, as well as medecine, katalyzing and so forth. The final conclusions concerning the nature of the gene are expressed as follows: "the most acceptable concept looks this one; to consider the gene a chemical unit, a 'configuration of atoms', simplified as a molecule of a definite substance. The gene is a material unit in the full sense of the word, let alone the possibility that this unit is composed by subunits".

2817 Gardner, E. J.
Principles of genetics.
John Wiley & Sons, London & New York 1960 : 60s. : Pp. vii + 366 : figs. : tables.

If another text book of genetics were needed, this one could be recommended because of its sophisticated approach to the subject, which is treated historically, with a very personal note in describing the work of Mendel and other pioneers in the science. The reader is introduced painlessly to phenomena such as segregation, the laws of probability, nuclear structure and chromosome behaviour, with clear explanations of how their discovery related to the development of biological science at the time; the main elements of modern cytogenetics follow in easy stages. These include considerations of gene structure and action, artificial induction of mutations, nucleic acids and their structure, killer factors, population genetics, natural selection, evolution and the effects of different systems of mating. This last section contains some useful practical hints for plant and animal breeders, particularly regarding the relative advantages of inbreeding and outbreeding; the eugenic viewpoint is also represented in this and in the final chapter, which is devoted to the application of genetics to the practical improvement of plants, animals and man.

Each chapter is provided with a selected list of bibliographical references, the value of which is enhanced by the addition of brief synopses, in a couple of lines, of the ground covered by each work cited. A set of problems for the student is also appended to each chapter.

2818 Heilbronn, A. & Kosswig, C.
Principia Genetica.
Verlag Paul Parey, Hamburg & Berlin 1961 : DM 5.40 : Pp. 40.

In tribute to the centenary of Mendel's experiments, the authors have compiled this set of 294 "principles" of genetics. Each principle, beginning with the dictum that every organism capable of sexual reproduction started life as a single cell, is succinctly expressed, usually in the form of a definition, and most of them follow on logically from the preceding principles. Many definitions are clarified by examples or by cross reference to definitions of other terms or by brief reservations covering special cases; this is not however invariably done: certain terms, such as panmictic and plasmon, seem never to be explained and a reference to the latter in the index leads only to a definition of nucleic acids. In certain cases bibliographical references are appended to the definitions, indicating the source of the first published reference to it. Occasionally an idea is marked with *, to show that it is merely speculative. The *Principia* should serve as a valuable exercise for students and a reference book for those wishing to clarify their ideas on any of the terms included in the alphabetical index at the end of the volume. The last principle emphasizes the fact that predictions in the realm of biology can only be made on the basis of probability values.

2819 SÁNCHEZ-MONGE Y PARELLADA, E.
Genética. (**Genetics**).
Madrid 1961 : 380 Pesetas : Pp. xii + 437 : 87 figs. : 38 tables.

This volume is designed to give a Spanish-speaking reader the main facts of the modern science of heredity. The role of the nucleus and its modes of division are described, the Mendelian laws are explained and an outline is given of the principles of statistical analysis and of quantitative inheritance, sex determination and sex linkage. There follow chapters on polyploidy, structural chromosome changes, mutation, chromosome mapping, cytoplasmic inheritance, population genetics, and the nature of gene action. Contributions of genetics to the study of evolution are considered and two final chapters deal with the genetics of micro-organisms and of man. Appendices give the main dates in the history of genetics, the international rules for genetic symbols, a glossary of genetic expressions, a set of problems for the student and a list of recommended books. The volume is completed by a combined subject and author index.

2820 HASKELL, G.
Practical heredity with Drosophila.
Oliver and Boyd, Edinburgh & London 1961 : 10s. 6d. : Pp. xii + 124 : 24 figs. : 14 tables.

As the introduction to this volume points out, questions on heredity in the botany and zoology papers of the intermediate B.Sc. and equivalent school examinations can no longer be passed without some practical work in genetics. Dr. Haskell, a geneticist at the Scottish Horticultural Research Institute, has produced a modestly priced, well illustrated book which should serve as a useful guide to elementary laboratory experiments with *Drosophila*. In the first few chapters, emphasis is placed on information indispensable to the student, the procuring and preservation of *Drosophila* supplies, the apparatus required for experimental work, the life cycle of the insect and the accepted nomenclature of mutant forms. In the second part of the book, a number of experiments illustrating the basic principles of Mendelian genetics are suggested. Reference is also made to elementary cytological studies that may be undertaken with *Drosophila*. Two of the final chapters deal with biometrical techniques relevant to the genetical experiments suggested.

2821 BOURNE, G. H. & DANIELLI, J. F. (Editors).
International review of cytology. Volume IX.
Academic Press, New York & London 1960 : $13.00 : Pp. 424 : figs. : tables.

The first contribution in this issue [cf. XXX, 938] is The influence of cultural conditions on bacterial cytology, by J. F. Wilkinson and J. P. Duguid. Though the review is largely concerned with phenotypic modifications directly impressed by the cultural conditions, consideration is also given to changes occasioned by the selection of mutant cells with altered morphology. A review of Organizational patterns within chromosomes is presented by B. P. Kaufmann, H. Gay and M. R. McDonald, the details of chromosome structure as revealed by modern techniques being described. The absence of a chromosome sheath, the fibrillar structure of the chromosome, with a helical arrangement of the fibrils, and the role of both nucleic acids and proteins in the maintenance of chromosomal stability are some of the points that emerge from the survey and the view is expressed that "the chromosome represents a complex fabric in which DNA and RNA are intimately associated with each other and with histones and non-histone proteins. No one component can be singled out as the essential structural material. As the metabolic properties change from phase to phase and from cell type to cell type, structural patterns also change." G. B. Wilson writes on The study of drug effects at the cytological level. A section of the review is devoted to the action of chemical substances in inducing mutation, which is assumed to be by impairing the DNA molecule, though it is emphasized that this remains largely a conjecture. Another section deals with chromosome fragmentation and here it is mentioned that the author has failed to confirm the radiomimetic action of penicillin and various phenolic substances reported by other workers. It is moreover suggested that some radiomimetic substances may affect the protein skeleton whereas others affect the DNA. In other sections carcinogenic and antimitotic activities are considered and we learn that most antibiotics act as prophase poisons, though to what extent they owe this to similar modes of action remains undecided.

Other reviews in this volume deal with enzymic processes in cells, the adhesion of cells, mitochondrial morphology, histochemistry of lipids in oogenesis, cytoembryology of echinoderms and amphibia, and the cytochemistry of non-enzyme proteins.

2822 Ruhland, W.
Handbuch der Pflanzenphysiologie. Band V. (**Encyclopedia of plant physiology. Volume V**).
Springer-Verlag, Berlin 1960 : bound DM 530 : subscription DM 424 : Pt. 1 : Pp. xl + 1013; Pt. 2 : Pp. xvi + 868 : figs. : tables.

The fifth volume of the series [cf. XXX, 2138] is in two parts. After a series of contributions on the occurrence of carbon dioxide in nature there is a section devoted to photosynthesis and studies of chlorophyll and related pigments, which includes essays on chloroplast structure and on photochemical activity in isolated chloroplasts; there is reference to the use of mutant strains for studies of pigment synthesis. Various factors that affect photosynthesis are considered in part 2, which includes essays on experimentally induced and natural adaptations and on the photosynthetic activities of different groups of plants and bacteria. Another section deals with chemosynthesis in various groups of bacteria and other microorganisms.

The volume is supplied with the usual set of excellent indexes.

2823 Chargaff, E. & Davidson, J. N. (Editors).
The nucleic acids. Volume III.
Academic Press, New York & London 1960 : 128s. 6d. : Pp. xvi + 588 : figs. : tables.

The third volume [cf. XXV, p. 630] comprises contributions on aspects not covered fully in the two previous volumes or those in which particularly rapid progress has been made. In Deoxyribonucleic acid as macromolecules, C. L. Sadron explains the principles and methods of studying macromolecules and proceeds to outline what is known of the structure of the DNA macromolecule. We find that DNA particles are rigid whereas RNA behaves as "a quite flexible polyelectrolyte". In dilute solution the particles of DNA have a linear configuration and a molecular weight compatible with the Watson-Crick double helix but the precise nature of the pleating or folding of the DNA round the protein molecules remains a matter of speculation. No structural differences have been detected between DNA from different organisms.

There are chapters on chemistry of nucleic acids and polynucleotides and R. L. Sinsheimer writes on The nucleic acids of the bacterial viruses, the processes of bacteriophage infection being described first for the T-even phages; various lines of evidence on the structure of their nucleic acids lead to the conclusion that their DNA consists of two functionally independent components. There are indications that DNA replication can take place without protein synthesis, that new enzymes are formed during the first few minutes of infection, and that a close relationship exists between the nucleotide composition of new RNA and that of the DNA of the infecting phage, this change of pattern being evidently dependent on the presence of protein. Much evidence is assembled in support of the belief that genetic loci consist of "discrete regions of the DNA structure". Studies on chemical mutagens and compounds that favour reverse mutations are shedding light on the structure and composition of DNA; changes of a single nucleotide pair can produce mutation but certain sites in the locus seem to be more sensitive than others, the sensitive sites being different for each mutagen. Certain mutagens increase the number of heterogenotes from mixed infections and there is evidence that a single DNA strand is adequate to convey genetic information. A review of information concerning the other phages discloses differences in nucleotide composition, sensitivity to ultraviolet irradiation and antigenic and other properties, many of which suggest a lesser degree of genetic homology with the host genome. As for the temperate phages, we are told that their nature, "which is almost invariably assumed to be DNA, can scarcely be regarded as convincingly demonstrated". The minute bacteriophages, in which the DNA seems to be single-stranded, also pose special problems concerning its mode of replication.

H. Schuster reviews The ribonucleic acids of viruses. Early reports of the existence of both types of nucleic acids in the same virus have now apparently been disproved, and all plant viruses studied have been found to contain only RNA. Details are presented of the structure of tobacco mosaic virus and of the properties of the RNA from it. Deamination may result in inactivation, in mutation or, in certain cases, in no apparent effect, and the production of mutants follows a single-hit curve. Similar mutants may result from deamination of different nucleotides. Studies on infective RNA and on reconstitution of virus from RNA and protein are reviewed and similar data are then surveyed for other plant viruses and for animal viruses.

There are reviews on the biosynthesis of purine and pyrimidine nucleotides and of proteins and on the relationship of nucleic acid and protein synthesis. R. E. Handschumacher and A. D. Welch review Agents which influence nucleic acid metabolism, the agents being classed as those that interfere with folic-acid derived enzymes, purine and pyrimidine synthesis and others; the biological activity of many structural analogues of purines and pyrimidines is examined. Several notes of warning against drawing unfounded conclusions are sounded but it is anticipated that "in the next few years much more will be discovered concerning the mechanisms by which macromolecules of nucleic acid participate in protein synthesis and in the transfer of genetic information".

The last chapter is on The effect of radiations on nucleic acid metabolism by L. G. Lajtha, who confines his attention mainly to DNA. The various effects of irradiation upon the cell are examined, and the results are found to show that irradiation can depress DNA synthesis during interphase, the radiosensitivity differing in different types of cells; thus small doses of radiation delivered before the beginning of the period of DNA synthesis can delay the onset of synthesis, whereas once synthesis has begun much larger doses are required to interfere significantly with the process. There are suggestions that the process of triphosphorylation is involved. Nevertheless, DNA synthesis has proved to be less radiosensitive than processes such as mitosis or chromosome and gene mutation.

2824 Lewis, G. J.
The genus *Babiana.*
J. S. Afr. Bot. 1959 : Suppl. Vol. III : Pp. 149 : 33 plates.

The corms of this genus are a favourite food of baboons, or "bobbejane" as they are called in Afrikaans, and it is from this word that Ker derived the name *Babiana*, which he established as a genus in 1802. *Babiana* has a curious distribution, with one species on the island of Socotra and the remainder in South Africa and South West Africa. Its taxonomy has been subject to the inevitable confusion resulting from incomplete descriptions by early writers, poor herbarium material, misidentifications and variability in the field due to environment and interspecific hybridization. Studying the plants, as all taxonomists should, not only in herbaria but also in the field and in cultivation, the author has been able to unravel some nomenclatural tangles and to bring order into a genus, some of whose species have at different times been variously assigned to the genera *Acidanthera*, *Antholyza*, *Gladiolus*, *Ixia* and others. The number of species, given as "about 80" in the 1951 edition of the *Genera of South African Plants*, has been reduced to 61, of which 24 are new. Several names referred to in the literature are regarded as *nomina nuda* and others are excluded through lack of material. This is not an exhaustive revision of the genus: there are incomplete herbarium specimens which the author has seen but not been able to identify, and it is likely that some species remain to be discovered in little explored areas of Namaqualand; also, the cytological studies which could help to clarify interspecific relationships have as yet scarcely begun. This is however a useful basic study. Its value and appearance are enhanced by the author's own water-colour drawings, some of them reproduced in colour.

2825 Norman, A. G. (Editor).
Advances in agronomy. Vol. 12.
Academic Press, New York and London 1960 : $12.50 : Pp. xi + 464 : figs. : tables.

The first contribution in this issue [cf. XXX, 2141] is on the clay fraction in soils and the second is again a collaborative review, on Technological advances in grass and legume seed production and testing, coordinated by C. S. Garrison. The review is in sections, each contributed by a different author, the first section dealing with maintaining varietal purity; it gives a full account of the grass and legume seed industry in the USA, including details of the system of seed certification; another part deals with maintaining the variety and mentions a number of cases where the physiological and other properties of a cultivar have been found to differ according to the locality or environment in which it was grown. The next section is devoted to insect pollination of forage legumes; after some general observations the main species are treated separately. A separate section dealing with insects affecting production of seed includes information on the main insects that cause damage to leguminous crops. Other sections are devoted to disease control and quality determination of forage seeds.

In the last contribution in this issue, E. N. Fergus and E. A. Holloway write on Red clover; an introduction dealing with the economic importance of *Trifolium pratense* is followed by a section on origin and early history, the first published mention of its cultivation being ascribed to Albertus Magnus in the thirteenth century; there are sections on taxonomy, morphology, physiology and ecology, diseases and nematodes, destructive insects and mites, weeds, and breeding and genetics; this last deals in turn with various forms of selection, inbreeding, polyploidy, interspecific hybridization, irradiation and varieties; under the last heading there is an alphabetical list of the North American cultivars with indications of their properties and origin. A section devoted to genetics gives summarized information on the inheritance of a number of morphological and agronomic characteristics and on the known linkages. Further sections deal with the use of red clover in agriculture, seed production, pollination, harvesting and seed certification.

Another contribution in the issue is Physiology of soybeans, by R. W. Howell, which contains sections on germination, root and shoot growth, flowering, and pod and seed development. Other contributions deal with fertilizers in forestry, agronomy in the southwest of the USA, mineral nutrition of soya beans and water infiltration into soils.

2826 **The world of learning.**
Europa Publications Ltd., London 1960–61 : 11th Ed. : £7 : Pp. xiv + 1282.

Readers of *Plant Breeding Abstracts* will require no introduction to this recognized work of reference, the eleventh edition of which follows the arrangement of its predecessors [XXX, 2142]. The compilers have not only to keep up with newly established institutions and changes affecting old ones in the various countries but also with the political changes in any way altering the map of the world. These tasks they have again managed to accomplish and the work still somehow does not burst at the seams with the further load of revisions and additions, the increase in page number over the previous edition being about 50.

2827 Praktická agrotechnika. (**Practical agrotechnique.**)
Státní Zemědělské Nakladatelství, Praha 1955 : Kčs 37,70 : Pp. 460 : 70 figs. : tables.

This manual, designed for agricultural workers on cooperative and state farms and for students in agricultural colleges, is divided into two parts; the first is concerned with the general principles of crop production and the second deals separately with the cultivation of crops important in Czechoslovakia. Some useful diagrams and photographs are included.

2828 VIENNOT-BOURGIN, G.
Rapports du sol et de la végétation. (**Soil-vegetation relationships**).
Masson et Cie, Paris 1960 : 24 NF : Pp. 183 : figs.

The extent of French contributions to the knowledge of factors influencing agricultural development in Africa and Asia may be assessed from the contents of this volume, the report of a colloquium organized by the Botanical Society of France with the participation of soil scientists, agronomists and botanists. The first part deals with the influence of vegetation on soil, the second with the influence of edaphic factors on vegetation. Most of the contributions deal with ecological relationships in specific areas and of these, more than two-thirds refer to problems in various parts of Africa. The standard of publication is high; it is, however, regretted that a hard cover could not be provided.

2829 STAPP, C.
Bacterial plant pathogens.
Clarendon Press : Oxford University Press 1961 : 42s. : Pp. xviii + 292 : 100 figs. : 4 tables.

Professor Stapp's book *Pflanzenpathogene Bakterien* has become a standard work on the subject and English-speaking readers will be pleased to have it available in an English version. The book starts by providing the reader with a thoroughgoing set of instructions for his basic techniques. Then comes a special part, in which bacterial phytopathogens occurring in central Europe are described. Easy reference is achieved by arranging them alphabetically in order first of genus, then of species. The descriptions include two species whose occurrence in Germany has been referred to in the literature, though they could not be confirmed during the past 30–40 years; these are *Erwinia amylovora* and *Corynebacterium flaccumfaciens*. The descriptions are very full and include such aspects as mode of infection, geographical distribution, disease symptoms produced, common names of the disease, host range, occurrence of resistance and other methods of control. Lists of recent references, drawn from a wide range of publications, are given after the entries for the respective species. The volume is also provided with a very comprehensive subject index. It is probably no fault of the translator that the original German title is misquoted on the title page. The Titan appearing on p. 60 is, however, clearly a mistranslation for titanium and is a typical example of a number of inaccuracies in translation that occur throughout the text.

2830 AINSWORTH, G. C. & BISBY, G. R.
A dictionary of the fungi.
Commonwealth Mycological Institute, Kew, Surrey 1961 : 5th ed. : 30s. : Pp. viii + 547 : figs.

The present edition of this mycologists' *vade mecum* is similar in format to the previous edition [cf. XXV, p. 104] but has been brought up to date by the inclusion of 500 more generic names. In addition, more than 5000 corrections or alterations have been made to the text and a new set of illustrations has been prepared. In response to suggestions from taxonomic mycologists, the dates of genera proposed between 1920 and 1939 are now given.

2831 SUBRAMANIAN, C. L. & SRINIVASAN, A. R.
A review of literature on the phanerogamous parasites.
Indian Council of Agricultural Research, New Delhi 1960 : Monograph 10.24 : 4s. 3d. : Pp. ii + 96.

Approximately 500 references were consulted in the preparation of this comprehensive monograph, which should serve as a useful guide for research workers in branches of agricultural science concerned with parasitic angiosperms. A total of 59 genera, belonging to 11 dicotyledonous families, are dealt with in some detail but brief reference is also made to other less important genera. For each of the main genera, available literature on the following aspects is reviewed; distribution of different species, morphological and anatomical characteristics, life cycle, seed viability, host range, damage caused and control measures. In the case of *Orobanche* and *Striga*, a brief account is given of progress in the breeding of crop varieties resistant to these parasites.

The value of this publication would have been enhanced if the proof reading had been as efficient as the actual compilation of the review. For example, on page 84, in the list of references, a paper by S. D. Timson on Trap-cropping to control witchweed, appears as Timsnd, L. D. (1945a). "Transporopping to control witchweed".

2832 ALLARD, R. W.
Principles of plant breeding.
John Wiley & Sons, London & New York 1960 : 72s. : Pp. xi + 485 : figs. : tables.

As can be expected from the title, this new book on plant breeding concentrates more on the principles and less on the achievements, particular attention being accorded to questions of population genetics, selection pressure and allied topics. A knowledge of the basic principles of cytogenetics is assumed and the volume starts, very logically, with an account of the main lines along which our present cultivated plants have evolved; segregation, interspecific hybridization and polyploidy are considered as the main guiding forces. Plant introduction is considered in a separate chapter, where the importance of world collections is explained; we are told that "to examine the entire world wheat collection of the United States Department of Agriculture requires about twenty-five working days, if only one minute is spent on each entry".

The different types of reproductive systems and the way they affect breeding techniques are considered, the genetic effects of selection and of hybridization and the advantages of back crossing being explained. Three chapters are devoted to quantitative inheritance. The methods of pure-line breeding and mass selection as applied to self-fertilized plants are then described; as an example of the success of the former method, the many selections from the Crimean wheat Krymka, introduced to America under the name Turkey, are cited, other examples being the Fulghum oat and the selections of Dwarf Yellow Milo resistant to sorghum root rot (*Periconia circinata*). Pedigree selection in hybrid progenies is described in detail for each generation, some of the refinements in predicting the value of families in the early stages, as developed by Comstock and his colleagues, being referred to. A special chapter is assigned to the bulk-population method, the experiments of Harlan and Martini [IX, 259] and Suneson [XIII, 806] on mixtures of varieties being reported in full; another deals with the back-cross method, the success of which is exemplified by the production of the wheats Baart [cf. XXIII, 2322], Big Club 53 and Onas 53 and the lucerne Caliverde.

A parallel series of chapters now follows dealing with breeding methods for cross-pollinated crops, starting with an explanation of the principles of population genetics.

A number of different types of selection effect are analysed, the importance of gene complexes and the release of potential variability being explained. Consideration is given to the genetic consequences of different systems of mating and to the causes of inbreeding depression and heterosis. The view favoured is that "the genes concerned with heterotic effects may be fully as complex in their interactions as the qualitative genes of classical genetics", and that neither the dominance nor the overdominance hypotheses can be expected to give a complete interpretation of the facts. Various types of mating system that favour cross pollination are described, reference being made in particular to the many forms of sterility and incompatibility found in crop plants. One of the obstacles to the use of male sterility in plant breeding is thought to consist in "the numerous opportunities for blunders". Several modifications of the selection method that have been applied in breeding cross-pollinated crops are outlined, recurrent selection being accorded a separate chapter; an impressive list of varieties produced in the USA by mass selection alone includes many well known varieties of forage crops, maize, sugar beet and lucerne. The history of hybrid maize in the USA and methods of producing it are outlined, a very brief reference being made to hybrid varieties in crops other than maize. Synthetic varieties are considered in chapter 24, mention being made of the successful use of maize synthetics in "countries where there is no well-developed seed industry". Several synthetic varieties of grasses and forage legumes are also referred to.

The next section deals with breeding for disease resistance, consideration being given first to the genetic systems of the pathogenic fungi, with a brief reference of one paragraph to similar phenomena in bacteria, viruses and other parasites, the viruses being disposed of in one sentence: "the viruses have also been shown to be complex genetically".

The disease reaction of the host species is treated in chapter 26; Flor's scheme of complementary genes in host and parasite is presented and the view is expressed that such a situation may be general: "since obligate parasites cannot live apart from their host, it is clear that host and parasite must have evolved together". Resistance to insects is dealt with in a little over half a page. The practice of breeding for disease resistance is treated in the next chapter, where examples are cited of the complications arising from changes in racial composition of the parasite. Though composite varieties are among the solutions considered, the author is of the opinion that strains carrying multiple resistance provide a hopeful line of approach.

The next two sections deal with polyploidy and interspecific crossing respectively; the value of the use of aneuploids is illustrated by the work of Sears, Unrau and others on wheat. Tetrasomic inheritance in autotetraploids is explained but "the student who is willing to brace the complexities of hexasomic inheritance is referred to the papers of Sir Ronald Fisher and his collaborators". The role of amphidiploidy is illustrated by the species of *Triticum*, *Nicotiana*, *Gossypium* and *Brassica*. The results of artificial polyploidy in plant breeding are pronounced generally disappointing, exceptions quoted being tetraploid rye, triploid water melons and sugar beets, and certain tetraploid fodder plants, though for most of these considerable reservations are made. Examples of the successful use of interspecific crossing are taken from *Lycopersicon*, *Triticum* and various forest trees. An equally cautious attitude is taken towards the results of mutation breeding; the statement of p. 445 however, to the effect that "no commercial variety of barley has as yet originated from the program" in Sweden, requires correction as it fails to take into account the issue of Pallas barley in 1959 [cf. XXIX, 3520].

The last chapter deals with the distribution and maintenance of improved varieties and includes definitions of the main types of seed: breeder, foundation, registered and certified. There is a glossary of technical terms and a combined author and subject index.

Since the volume is said to be for the benefit of undergraduate students it is a pity that more accuracy has not been attained in the bibliographies at the ends of the chapters, which contain all too frequent inaccuracies and take no account of accentuation in citations of non-English proper names. Nor do the citations in the text, which moreover contains a number of other inaccuracies. Thus the $2n$, $3n$ and $4n$ potatoes from Bolivia are referred to as all belonging to the species *Solanum tuberosum*. On p. 59 we meet the statement that "Mutation studies in higher plants are almost entirely confined to maize". The statement on p. 359 that "sugar production rests on varieties of sugar beet", ignoring the existence of tropical sugar cane, illustrates a general tendency to confine the interest to work done, and crops grown, in the USA, though this limitation is not specified in either title or preface. There are frequent errors in quoting Latin names, *Dioscorea* appearing as *Dioscoria*, *Gossypium herbaceum* as *G. arbaceum*, *G. arboreum* as *G. aborum*, *Tripsacum* as *Tripsicum*, *Agropyron* as *Agrophyron* and so on. Many other errors of a kind that Professor Allard, we trust, would not tolerate in his undergraduate students, occur in the text.

2833 Pridham, J. B. (Editor).
Phenolics in plants in health and disease. Proceedings of a Plant Phenolics Group Symposium held at Bristol, April 1959.
Pergamon Press, Oxford & London 1960 : 42s. : Pp. ix + 131 : figs. : tables.

As the editor points out in the preface, the importance of phenolic compounds during the life cycle of plants is becoming increasingly evident in a wide variety of fields of enquiry. The symposium was divided into four sessions, respectively dealing with general subjects, lignification, plant pathology and genetics. In the general section, a miscellany of subjects is considered, papers being given on the distribution of phenolic compounds in apple and pear trees, the formation and possible functions of phenolic glycosides, betanin production in beetroot, germination inhibitors in seeds and other plant parts and also in yeast and spores of wheat stem rust, and inhibitory substances in sugar-beet glomerules. The topics discussed in the second part are as follows: some interrelationships between leucoanthocyanins and lignin; the formation of lignin; and lignification in stock-scion junctions and its relation to compatibility. The third section opens with The metabolism of aromatic compounds by fungi by D. Woodcock, followed by a report on research into the effect of phenolic compounds on the growth and sporulation of *Venturia inaequalis* and *V. pyrina*, by A. E. Flood and D. S. Kirkham. A. C. Hulme and K. L. Edney continue, describing investigations on phenolic substances in the peel of Cox's Orange Pippin apples with reference to infection during storage by *Gloeosporium perennans*. R. J. W. Byrde, A. H. Fielding and A. H. Williams contribute an account of work on the role of oxidized polyphenols in the varietal resistance of apples to brown rot (*Sclerotinia fructigena*). From their investigations at Long Ashton Research Station, University of Bristol, they conclude that polyphenols in apple fruits probably form a defence mechanism against this disease. On injury to the fruit, these compounds are oxidized by the host enzymes. The oxidized polyphenols inactivate the extracellular pectolytic enzymes of the fungus, which, there is good reason to believe, are necessary for its pathogenicity. C. H. Cadman, in Inhibition of plant virus infection by tannins, concludes that work with viruses throws no light on the functions of tannins in plants. Moreover, although polyphenolic compounds seem to be associated with resistance of plants to attack by fungal pathogens, there is no evidence that they confer any protection against infection by insect-transmitted or soil-borne viruses in the field. In the final section, J. B. Harborne reviews information on genetic variation of anthocyanin pigments, mainly with reference to investigations on flower-colour mutants of various plants at the John Innes Horticultural Institution. Hydroxylation, methylation and glycosylation and co-pigmentation with flavonols and the genetic control of these processes are discussed. It is considered that the basic pattern of pigment synthesis which applies, with minor modifications, to all the higher plants has now been established. R. C. Pecket reports on analyses of the phenolic constituents of leaves and flowers of over 20 species of *Lathyrus*, and draws attention to the taxonomic signicance of data on these compounds [XXX, 2798]. The section concludes with The genetic control of the formation of phenolic compounds in the seedcoat of *Phaseolus vulgaris*, by W. J. Feenstra [1058]. Summaries of the discussions of each paper and of the general discussions at the end of the sessions add to the value of the record of the symposium.

2834 Zonarea ecologică a plantelor agricole în R.P.R. (**The ecological zonation of agricultural plants in the Rumanian People's Republic**).
Editura Academiei Republicii Populare Romîne 1960 : Lei 18,50 : Pp. 286 : 24 figs. : 9 tables.

Two of the most characteristic aspects of the agricultural planning policies of the eastern European countries in recent years have been varietal standardization of crop plants and the demarcation of zones best able to grow the various crops. In no country have these objectives been pursued more assiduously than in Rumania, and in the present collective volume, we have a series of maps and explanatory text, in which the zones suitable for the major Rumanian crops are shown. The zones have been determined by combining climatic data (temperature, precipitation and wind strength) with pedological data and observations on the crops actually grown. The crops considered in detail are: maize, winter wheat, spring barley, oats, peas, French beans, soya beans, sunflower, hemp, flax, sugar beet, potato, tobacco, Sudan grass, vetch, mangels, lucerne, red clover and sainfoin.

2835 Vavilov, N. I.
World resources of cereals, leguminous seed crops and flax, and their utilization in plant breeding. Agro-ecological survey of the main field crops.
Israel Program for Scientific Translations
1957 : Pp. 442 : 167 figs. : 108 tables : 9 maps.

The original Russian edition of which this is a translation was published in 1957 and reviewed in this journal [XXVIII, 3576]. The translation is on the whole comprehensible, though a certain confusion has arisen from the translators' having chosen to render the Russian word Растениеводство by "plant breeding" rather than "plant industry" and Селекция by "plant selection" instead of "plant breeding". The translators have not adopted a common system of equivalents, vernalization appearing in some sections as such and in some as yarovization, Nahičevan in some as Nakhi Shevan and in others as Nakhichevan and so on. Rusts are sometimes rendered as rusts but frequently as smut; lodging is rendered variously by "being beaten down", "density of pith", "a recumbent tendency" and "proneness to recline", strong straw occasionally by "solid straw" and solid straw by "full straw"; breeders are referred to as "selectionists" and "selectors", species often as "forms"; shedding is rendered by "scattering" and "crumbling"; and glumes appear as "scales", "pellicles" and "bracts"; flax capsules appear as "bolls", "pods" and "bells", and linseed as "curly flax" and "bushy flax". Agricultural varieties or cultivars have been rendered variously as "grades", "types", "selection types", "races" and "strains" as well as "varieties". Nursery has been rendered by "arboretum", crossing by "cross-breeding", creeping by "spreading", low tiller number by "low stalks", herbaceous plants by "grasses", root crops by "rhizocarps", delayed flowering by "developed a floscule", loose smut by "dusty smut"; and alternate hosts appear as "the fact that land changes hands now and then"! The frit fly is referred to as the "Swedish fly", six-rowed barley as "six-sided", ears as "clusters", spikelets as "heads", club wheat as "dwarf", bread wheat as "dry wheat", Einkorn as "one-grained plants", dehiscent flax as "creeping", tillering as "bushiness", forage grass as "forage grain", *Aegilops* as "wild oats", common vetch as "sown vetch", a broad rachis (in wheat) as a "spiked axis" and inflated wheats as "expanded forms with typical bent scale prongs". In one place a plant population was referred to as if it were "the local community". There are various minor inaccuracies, Cuzco appearing as Kuskl, Svalöf as Svalefskaya, Gökgöl as Gëkgël and so on, and of course all the errors previously referred to [*loc. cit.*] as occurring in the original text are reproduced, with a few additional ones added.

Translations of this kind are undoubtedly useful to scientists; they would be incomparably more so however if they were made by translators possessed of a thorough knowledge of the subject.

2836 Maloch, M., Regal, V., Bureš, F. & Klofera, V.
Pícninářství. (**Fodder plant production).**
Státní Zemědělské Nakladatelství, Praha
1956 : Kčs 50,30 : Pp. 496 : 126 figs. : 57 tables : 1 map.

This text book has been prepared primarily for students in the agricultural colleges of Czechoslovakia. The first part deals fully with the management of meadows and pastures and includes descriptions of the characters and uses of important grasses; there is a small section on the breeding and seed production of grasses and another deals with pests and diseases. Leguminous fodder plants and other field crops are considered in the second part. Useful diagrams and photographs, author and subject indexes, a list of Czech technical terms with Slovak equivalents and a short bibliography are included.

2837 Bor, N. L.
Grasses of Burma, Ceylon, India and Pakistan.
Pergamon Press Ltd., Oxford & London
1960 : £8 : Pp. xviii + 767 : 80 figs.

The means of distinguishing the indigenous and introduced grass species of Burma, Ceylon, India and Pakistan is said by Dr. Bor to have been the main objective in writing his book. The work has two parts, the first, a general section of sixty pages with four chapters, dealing respectively with the morphology, fruit and seed dispersal, uses of grasses, and obnoxious plants. The second section begins with a discussion of the characters used in classification and a brief outline of the possible phylogeny of the grasses. More than 700 pages are then devoted to a systematic study of plants in those parts of Asia indicated by the title; in this study the use of dichotomous keys plays an important role. The distribution of individual species is described, together with an indication of how common the plants are, their apparent ecological requirements, uses and any special features which they may possess.

The author has taken great care to present, together with the currently accepted nomenclature, lists of synonyms. The descriptions of plant characters are lucid; there are several explanations of botanical terms easily intelligible even to the layman. Dr. Bor is never afraid to point to deficiencies in his data; the lack of reliable information on poisonous properties of grasses is one such example, uncertainty, in some cases, of accurate classification another. Where several theories exist, they are considered and compared logically and fairly. Many potential investigations are indicated as are many present lines of taxonomic research. There are some 600 references covering world literature on many topics relating to the Gramineae.

The line drawings, where present, are excellent, though the value of the book would have been even further enhanced had there been, in both sections, more such drawings. However, this is but a minor criticism of a monumental work which will be a standard reference book for many years.

2838 METCALFE, C. R.
Anatomy of the monocotyledons. I. Gramineae.
Clarendon Press : Oxford University Press 1960 : 84s. : Pp. lxi + 731 : 29 figs.

Ten years ago, the present author and Dr. Chalk published their monumental *Anatomy of the Dicotyledons* [cf. XXI, 454]. The present volume, devoted entirely to the Gramineae, is the first instalment of the results of the author's anatomical investigation of the monocotyledons, and, like its predecessor, will become a necessary item in any comprehensive botanical reference library.

The anatomy of the grasses is a specialized study and involves categories not encountered in the dicotyledons, nor even in other monocotyledons. For this reason, the author supplies an excellent introductory survey and explanation of the working concepts of the grass anatomist. This section of the book, and the succeeding section which deals with the value of anatomy as a tool in elucidating the taxonomy of the Gramineae, is worth reading even by botanists with no special interest in the grasses, since the assessment presented of the value of anatomy and of the status of the superior taxa within the Gramineae is unusually well-balanced and judicious, albeit noncommittal.

A realistic note is struck by Dr. Metcalfe's insistence that only rapidly performable anatomical investigations are of much use in taxonomy, consequently the author's treatment is devoted principally to the abaxial epidermis and transverse section of the leaf lamina. At a time when highly elaborate and time-consuming techniques are being used in taxonomic studies, this practicality is refreshing. With regard to the primary subdivision of the Gramineae, the author believes that the distinction, well supported anatomically, between the bambusoid, festucoid and panicoid grasses, is fundamental. Moreover, the tribes of the panicoid grasses are also well differentiated anatomically, though this is not so for the festucoid grasses. The author wisely infers that the concept of tribe in the two cases is probably divergent.

Cytogeneticists have long been unhappy with the genera of the Gramineae. Dr. Metcalfe confirms this uneasiness, remarking that anatomical investigation "makes it abundantly clear that there is a marked overlap in the characters of those genera that are generally accepted as being closely related to one another".

After the introductory sections, the main part of the book follows: detailed anatomical descriptions of the leaf and sometimes culm also, of some 400 species belonging to 206 genera, with allusion to the literature of many other genera too. This section is arranged in alphabetic order of genera, first the festucoid and panicoid grasses, and then the Bambuseae, a procedure fully justified by the present unsatisfactory status of the grass tribes. Readers should note that in this section horizontal means longitudinal and vertical, crosswise.

The book concludes with tables listing the genera and species in which certain diagnostic anatomical features occur, a bibliography, and twenty-nine pages of illustrations.

While this book is primarily an anatomical dictionary, it is written throughout with the findings of classical taxonomy in mind. The help given in this respect by C. E. Hubbard and N. L. Bor is acknowledged. Cytogeneticists, however, will regret that so little note is taken of the virtual revolution that they are effecting in grass taxonomy. In particular, one would have welcomed a discussion of the work of Tateoka, whose numerous studies of the combined value of anatomy and caryology in elucidating the taxonomy of the Gramineae will be familiar to readers of *Plant Breeding Abstracts.* In this connexion it should perhaps be pointed out that the papers of Tateoka cited in the bibliography are attributed to the *Japanese Journal of Botany*, which is in English; they should be referred to the *Shokubutsu Kenkyu Zasshi* (*Journal of Japanese Botany*), an entirely different journal in Japanese.

2839 DAVIES, W.
The grass crop, its development, use and maintenance.
E. & F. N. Spon Ltd., London 1960 : 2nd Ed. : 45s. : Pp. xv + 363 : 16 plates : 24 tables.

A vast amount of information on various aspects of grass has, of course, been published in Great Britain as well as in other countries. The author's declared aim is to "bring together in this book as much as possible of the available scientific evidence and practical experience in order to discuss the crop in all its aspects, and with particular reference to its value to livestock." How well the author succeeded in the first edition, published in 1952, may be judged from the enthusiastic reviews received from both farming and scientific circles. In this edition, additional material has been added to several chapters and chapters on Farming systems and Extending the grazing season have been included. Information about the latest experiments at the Grassland Research Institute, of which Dr. Davies is Director, has been included in the chapter on Ley farming. Frequent references are made to practical and scientific grassland problems in many parts of the world, particularly western Europe and the Commonwealth. For those interested in further reading on the subject, a bibliography that runs to thirty-five pages should prove valuable.

2840 KRASOČKIN, V. T.
(Beet).
Gos. Izdat. S.H. Lit., Moskva-Leningrad 1960 : R.9.75 : Pp. 439 : figs. : tables : plates. [Russian].

After some introductory matter giving details of the use of beet in the Soviet Union, the author considers the systematics of the genus *Beta*. Thirteen species are described, *B. maritima*, *B. orientalis* and *B. cicla* being regarded as distinct species [cf. XXX, 4061]. The main cultivars are arranged into five groups in *B. cicla* and are described and illustrated. *B. vulgaris* is divided into two subspecies; ssp. *asiatica*, comprising mangels, is again divided into groups, from the near East, Central Asia and the Mediterranean respectively, each group having a number of cultivars arranged together into "sortotypes"; in ssp. *europaea* three groups are distinguished, the mangels, table beets and sugar beets, each with a number of cultivars arranged in sortotypes.

The cultivation of beet is considered to have started some two thousand years BC, before which time it was used in the wild state, particularly in the Mediterranean region. References to its cultivation in ancient Greece and Rome are cited and its introduction into Kiev Russia from Byzantium is ascribed to the tenth century AD. The differentiation into table, forage and sugar beets occurred only in the 18th and 19th centuries.

Statistics are presented on the present cultivation of the various beet forms in the USSR. There follows a chapter on the physiology of development, which includes a review of published literature on the factors influencing bolting, and their inheritance. No correlation has been established between bolting and sugar content. Observations on a wide range of beets of different origin when grown in different parts of the Soviet Union showed resistance to bolting to be highest in forms from northerly latitudes; the tendency towards bolting increased progressively as the point of origin approached the equatorial latitudes. The varieties are divided into six groups according to their phasic requirements; when sown in northern latitudes, group 1 bolts 20–30 days from germination, group 2, 30–50 days, group 3 has 25–100% of bolters, group 4 has 30–50%, group 5 gives 20–50% bolting only after 80 days vernalization and group 6 only 1–20%. Some Scandinavian mangels and some table beets come into group 6, the majority of the standard Russian cultivars of mangel, sugar beet and chard coming into group 5.

F_1 hybrids between beets from different groups were grown in a number of localities at different latitudes. Hybrids from the same three annual beets showed varying degrees of bolting according to the biennial variety with which they were crossed. The actual numbers of bolters in both the F_1 and F_2 generations varied with the locality, being greater in the north and less in the south. Data are presented showing the effect of temperature, length of day and other factors on bolting in different varieties, a number of effects being shown to be out of conformity with the theory of phasic development.

An account is given of the range of variation encountered within the genus *Beta* in such attributes as weight of seed ball, size and pigmentation of cotyledons and various characters of the leaf and root, with indications in certain cases of their mode of inheritance and their reaction to differences in environment.

A chapter is devoted to the evolution of cultivated beets. The wild littoral beets of the Mediterranean are considered to be the primary forms and species adapted to high altitudes are regarded as derived forms. In India and other oriental countries the common beet forms fail to flower and *B. orientalis* has evidently evolved in response to selection for short vernalization stages and capacity to develop at high temperatures. Evolution in the opposite direction has occurred in the Scandinavian beets (*B. maritima* ssp. *danica*), which are distinguished by low rate of germination and development, relatively high self fertility and high dry-matter content. Most of the wild beets are physiologically heterogeneous, particularly in respect of bolting, and the biennial habit of the cultivated beets is thought to be a consequence of selection. Instances are cited where selection for a single generation has materially reduced the percentage of bolting. The thickened root is thought to have arisen not by interspecific crossing but by selection within the wide range of diversity of the leaf beets, which were the first to be taken into cultivation; intermediate forms between the leaf beet and beetroot are found to this day in Asia Minor and Central Asia. The first beetroots are thought to have arisen possibly in Mesopotamia and to have resembled the forms found today in western Anatolia and Afghanistan, characterized by very short developmental phases, large glomerules, weighing 5–6 g., small elongate roots and a strong tendency towards bolting. The practice of transplanting is thought to have been one of the first factors exerting selection for increased root size. Experiments are described in which leaf beets when grown at Majkop in the Caucasus under very favourable conditions formed thickened roots weighing up to 537 g. Selection against bolting has also led to forms with larger roots. It is pointed out that the mangels of the late 18th century were much closer in type to the chards, many of which contain 15–19% of sugar, and to the northern wild beets, some of which contain 14–20%, and to these is ascribed the origin of the sugar beet. The northern wild beets are thought to have contributed also to the origin of some of the garden beets, forms resembling the variety Green Top having segregated from crosses of Scandinavian wild beet with Flat Egyptian.

The unusual long-petioled beet of Asia Minor is invariably found in association with other crops such as lucerne or cotton and has evidently evolved in response to selection for ability to compete with these plants. The broad-petioled silvery chards of western Europe are thought to be derived from the wild beets of the Adriatic. Beets with red roots often appear in crosses between mangels with yellow and white roots and the red garden beets are thought to have arisen in this way, probably in Transcaucasia, where endemic forms with dark-red roots are still to be found, especially at high altitudes. Leaf beets possessing red pigmentation are also found in this area. The yellow forms, in which the pigment consists exclusively of flavonols, are thought to have evolved from the red, in which both red and yellow pigments are present.

After a chapter dealing with methods of beet cultivation we come to one devoted to breeding.

A brief outline is given of breeding work in Russia with table beets, mangels and sugar beets respectively, with tabular information on the varieties grown, their origin and the areas in which they are grown. By 1926–28 the yield of sugar per unit area from Soviet varieties of sugar beet exceeded that from imported varieties. The most widely grown of all Soviet varieties is Ramon' 06, an E type bred in 1949. Soviet breeders have derived great advantages from the world collection of beets, comprising over 1600 types, established by the Institute of Plant Industry. The techniques of mass, group and family selection are described and illustrated by diagrams. It is emphasized that selection in hybrid populations should be carried out under conditions corresponding to those in which the new varieties are to be grown. Soviet breeding methods make much use of interpollination between different plants of the same variety grown in different places or under different conditions of growth. Varieties produced by this method include Puškinskaja Ploskaja 18 [Puškin Flat 18], Leningradskaja Okruglaja 221 [Leningrad Round 221] and Severnaja Oranževaja 1033 [Northern Orange-yellow 1033], and sugar beets such as Ramon' 931, R–1537 and Verhnjačka 038. Progenies from large glomerules from the central stems of the inflorescence give higher yields than those from smaller ones, yields of 410 c. per ha. as against 228 c. being cited. Other features on which selection is based are rate of root formation in the early growth phases, the capacity to maintain the leaves in a green state until late in the autumn, maximum reaction to various fertilizers, earliness of seed maturity combined with freedom from bolting, and resistance to various diseases. The beets from the Canary Islands are named as useful sources of resistance to nematodes and virus yellows, wild beets from Algeria and the Adriatic coast for resistance to mosaic and *Cercospora*, and those from Scandinavia for resistance to *Peronospora*. Several Soviet varieties have been bred for resistance to storage rot (*Botrytis*). Others have been selected for the capacity to germinate at 3–6° C. Some hybrids of Barres Severnyj 1033 [Northern Barres 1033] with sugar beet and with wild Scandinavian beets have combined winter hardiness with relative freedom from bolting and may point the way to the production of winter beets. Winter and early spring sowing, growing in the extreme north and vernalization have all been used in breeding lines free from bolting. Experiments at Leningrad, where a number of varieties were sown in early spring in cold frames, showed a great range of reaction to vernalization in biennial varieties, which are classified into six groups according to the length of their vernalization stage. The groups with the shortest stage embrace most of the wild beets, the primitive leaf beets and the root beets of the Mediterranean area, those with the longest being VNIISP–1 [All-Union Research Institute for the Sugar Industry–1] and Tetraploid KVE from the Netherlands. A single generation of selection of nonbolting plants in the beetroot Puškinskaja Ploskaja reduced the proportion of bolters from 9·1 to 1·2%.

Drought resistance has proved to be greatest in beets with a high energy of growth in the early stages and during the summer, and by selecting on this basis the Ramon' station has produced a number of cultivars resistant to drought, one of the best being Ramon' 06. The first-generation hybrid between the chard Serebristyj k–48 [Silver k–48] and a sugar beet was more drought resistant than either of the parents. Among the mangels, the Barres lines are among the most tolerant of both drought and excessive humidity; and among the table beets those with green leaves are more drought resistant than those with pigmented leaves, since the pigment absorbs the sun's rays and raises the temperature by 2–3° C.

The best sugar-beet varieties of the Soviet Union in the period 1937–47 gave 10–12 c. per ha. more yield than those of 1929–34, an improvement of 20%, and were 0·4% better in sugar content. Record yields are quoted, one being 707·5 c. per ha. of roots with a sugar content of 17·8%, giving 125 c. of sugar per ha. The varieties V–020, V–031, R–023 and R–931 are cited as examples of beets having a root yield equal to mangels and a sugar content equal to the normal sugar beets. They were selected by cloning the mother plants and growing them under a variety of conditions of manuring, 1·5–2 kg. of seed of each mother plant being sown under wide spacing, the plants being fully studied at every stage of development during the two years of growth. The top buds of the beet having the highest sugar content, these were used for cloning. In the later phases of production of a variety, interpollination is practised between selections with similar sugar contents but possessing certain "biological differences". Selection in the early growth period, when the beets have 6 pairs of leaves, is performed on the basis of specific weight (determined in sugar solutions), root form and freedom from disease. At the end of the growing season those with the highest proportion of leaves that remain green are selected. Several hybrid varieties have been produced by crossing tonnage with high-sugar varieties. Increases in dry-matter content have been observed in crosses of chard and wild Scandinavian beets with mangels, beetroots and sugar beets, two hybrids of wild beet x sugar beet being cited as having 30% dry matter in the roots. Improvements in the sugar content of garden beets have been effected by crossing them with sugar beet. Fodder sugar beets are gradually taking the place of mangels in Russian agriculture; the second-generation hybrids of crosses between Ramon' sugar beets, with mean dry matter of 21·2%, and the Dorokshan white round mangel from Iran, with a dry matter of 8–14·2%, varied from 8 to 18% in dry matter and by continued selection followed by further pollination with sugar beet, it was raised to 18–24%; the best selections have shorter, rounder roots than sugar beets, are earlier and give 10–20% more yield of dry matter per hectare than the average mangel. One of them, named Round Sugar, had dry-matter contents varying from 17 to 24% in 1953 compared with 7·7–13% in Severnaja Oranževaja; all tendency to bolting has been removed by selection and the variety has proved more palatable to stock than ordinary mangels. Its mean yield in recent trials has been from 380 to 520 c. per ha., its dry matter 83·6–114 c. per ha., that of Severnaja

Oranževaja being 80·4–82·8 c. It is also much better in keeping capacity.

The first monogerm sugar beets were found in the Soviet Union in 1932 and the first pure monogerm family was produced in 1936; they are now sown on an area of 500,000 ha. They were at first defective in yield and other properties but lines have now been selected which outyield even the cultivar Ramon' 06. Both root yield and sugar content were increased by selecting for large seed. Monogerm forms have also been found in garden beet and on the principle of homologous variation a search for them is also being made in mangels.

A list of desiderata in breeding each of the three types of beet is given and various methods of increasing the pace of breeding work are suggested; chief among these are summer planting of freshly gathered seed, cloning, division of roots into 2 or 4 pieces, transplanting, and autumn planting in the greenhouse, the plants being subjected first to a period of cold (5–10° C.) and then to 15–20° C. with supplementary lighting. A method recommended consists in growing the young plants for a brief period in a greenhouse or hot frames and then transplanting them to the field. Thus seed of two beetroots and two mangels was sown in the greenhouse on 28 Feb., where the plants remained at 8–12° C. until 20 Mar., when they were transferred, in boxes, to a cold greenhouse, with night temperatures of 2–5° and day 5–20° C., until 1 May, when they were transferred to the open; they were transplanted on 29 May, when they had 3–4 foliage leaves. The two beetroots, Flat Egyptian and Crosby, gave 100% flowering and good seed set, the two mangels, Eckendorf Yellow and Barres, produced few mature seeds and clearly needed more vernalization. When this was applied to the seeds in December–January and again to the seedlings in February–April good results were obtained and the plants obtained from seed produced in one year were up to normal in root yield. If this technique is used too frequently however, it may result in an increased tendency to bolting, as seems to have happened in many American varieties.

The method of making sugar analyses in the spring is considered preferable to autumn analysis. The plants with the largest roots by June are selected for further observation, the final selections being made the following spring. Seven main stages in the process of breeding a new variety and the system of seed production employed in the Soviet Union are outlined, consideration being given to the effects of reproducing seed in different localities. Some areas in the Soviet Union have been shown to be more favourable for seed production than others, the seed from these areas giving rise to healthier plants with a lower percentage of bolting. The need to ensure 100% flowering to avoid any shift in phasic reaction through selection is emphasized.

A final chapter lists the main pests and diseases of beet in the USSR.

2841 Stehlík, V., Havránek, A. & Benc, S.
Řepařství. (**Beet production**).
Státní Zemědělské Nakladatelství, Praha 1956 : Kčs 54,40 : Pp. 430 : 181 figs. : 126 tables.

This useful handbook dealing with all aspects of sugar-beet production and utilization is divided into four sections. The first part includes, amongst others, chapters on the history of sugar beet cultivation, the botany of the sugar-beet plant, the characters of wild beets and the improvement of sugar beet with details of breeding work being carried out at Czechoslovak stations; there is also a chapter dealing with the qualities and regional distribution of different varieties. Other chapters in this section are concerned with seed production, the effect of the environment on beet development and variation in the weight and sugar content.

The second section deals with agronomy and includes chapters on cultivation of the soil, manuring, seed sowing and harvesting; the utilization of sugar beet and its secondary products for fodder and also the use of the secondary products for soil fertilization are considered. Diseases and pests of beets and methods of control are described in the third section and the fourth is concerned with the economic aspects of sugar-beet production. A bibliography and author and subject indexes complete the volume, which is well supplied with photographs and line drawings.

2842 Stehlík, V.
Pěstování rostlin. díl III. Cukrovka, čekanka a krmné okopaniny. (**The cultivation of plants. Part III. Sugar beet, chicory and fodder root crops**).
Státní Zemědělské Nakladatelství, Praha 1956 : Kčs 32, 10 : Pp. 305 : 160 figs. : 143 tables.

The author has devoted most space to beet production, chicory and the root crops, carrot, swede and turnip, being dealt with rather briefly. There are chapters on the varieties and breeding of beets and chicory. Numerous photographs and diagrams add interest to this text book which should be useful to agricultural students in Czechoslovakia. Each chapter is concluded by a bibliography and there is a list of general works at the end of the volume; subject and author indexes and a list of Czech technical terms with Slovak equivalents are included.

2843 Urquhart, D. H.
Cocoa.
Longmans, Green & Co. Ltd. 1961 : 2nd Ed. : 40s. : Pp. xxiii + 293 : 10 figs. : 17 tables : 119 plates.

Important developments in cacao production have occurred since the appearance of the first edition of this authoritative and comprehensive handbook [cf. XXV, p. 457]. Economic factors influencing the prosperity of the cacao-growing industry have changed appreciably. There has been a marked trend towards the adoption of more intensive methods of cultivation. Detailed investigations have been carried out in many parts of the world on methods of fertilization, pest and disease control, vegetative propagation, selection and breeding and on techniques for fermentation and drying of the crop.

The author, who was formerly Director of Agriculture in Ghana, had added new chapters dealing with planting material, manuring and marketing and has rewritten other parts of the text in order to present a complete, up-to-date survey of the crop in the light of these developments.

2844 Sonn, S. W.
Der Einfluss des Waldes auf die Böden. **(The influence of forest on soils).**
Gustav Fischer Verlag, Jena 1960 : DM 13.40 : Pp. xii + 166 : 28 figs. : 45 tables.

According to figures given in this volume, translated into German from the original Russian published in 1954, about one third of the world's forests are in the USSR. Details are given of the distribution of these forests, including many of those recently planted in the steppes and other unfavourable areas. Over 150 different species are now grown and studies have been made of the complex interrelationships that exist between the individual species and the accompanying herbaceous flora, the soil and the environment in general. The requirements of the principal forest species are analysed in respect of humidity, fertility, soil type, illumination, aeration and other factors, with indications of their typical reactions to deficiencies in any of these factors and the influence they exert on the properties of the soil. First to be considered are the main coniferous species; the chief broad-leaved species follow. The distribution of the species among the forests of the Soviet Union and the factors that determine it are analysed, special attention being given throughout to soil conditions. The ways in which these are altered by the various forest species and the accompanying vegetation form the subject of the remaining chapters, the object of the whole exercise being to provide guidance in planting new forests and in improving the condition of existing ones.

2845 Lee, W.
Fuchsias for greenhouse and garden.
Littlebury & Company Ltd., The Worcester Press, Worcester : Undated : 9s. 6d. : Pp. 47 : figs. : plates.

This unassuming little book does what it sets out to do: namely, to explain briefly and simply how to grow fuchsias. Chapter by chapter, in painless stages, we are told how to start a collection; how to pot the plants; how to train them as bushes, standards, pyramids, cones or fans, or grow them in hanging baskets; how to propagate them; what sort of care to give them during the course of the seasons; what to do about fertilizers; and what to do about pests. Two final chapters respectively describe the advantages of joining the British Fuchsia Society and list a number of varieties suitable for various purposes. The book also contains photographs of some handsome varieties and several helpful line drawings. Although the author's style is colloquial, elliptical and uncertain in punctuation, his meaning is generally clear and his book, based as it is on personal experience, will prove a useful source of advice to the would-be fuchsia grower.

NEW JOURNAL

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